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ABSTRACT

This participant manual was developed to accompany a workshop to provide environmental protection professionals with skills needed to plan and deliver training programs. Each of the ten units contains a unit overview, content summaries, assignments, and figures. The materials are designed to strengthen skills in designing instructional objectives, evaluating performance, choosing instructional methods, and managing instruction. (CLS)

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Water

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EPA

Advanced Instructional Technology

Participant Reference Manual

U S DEPARTMENT OF HEALTH.
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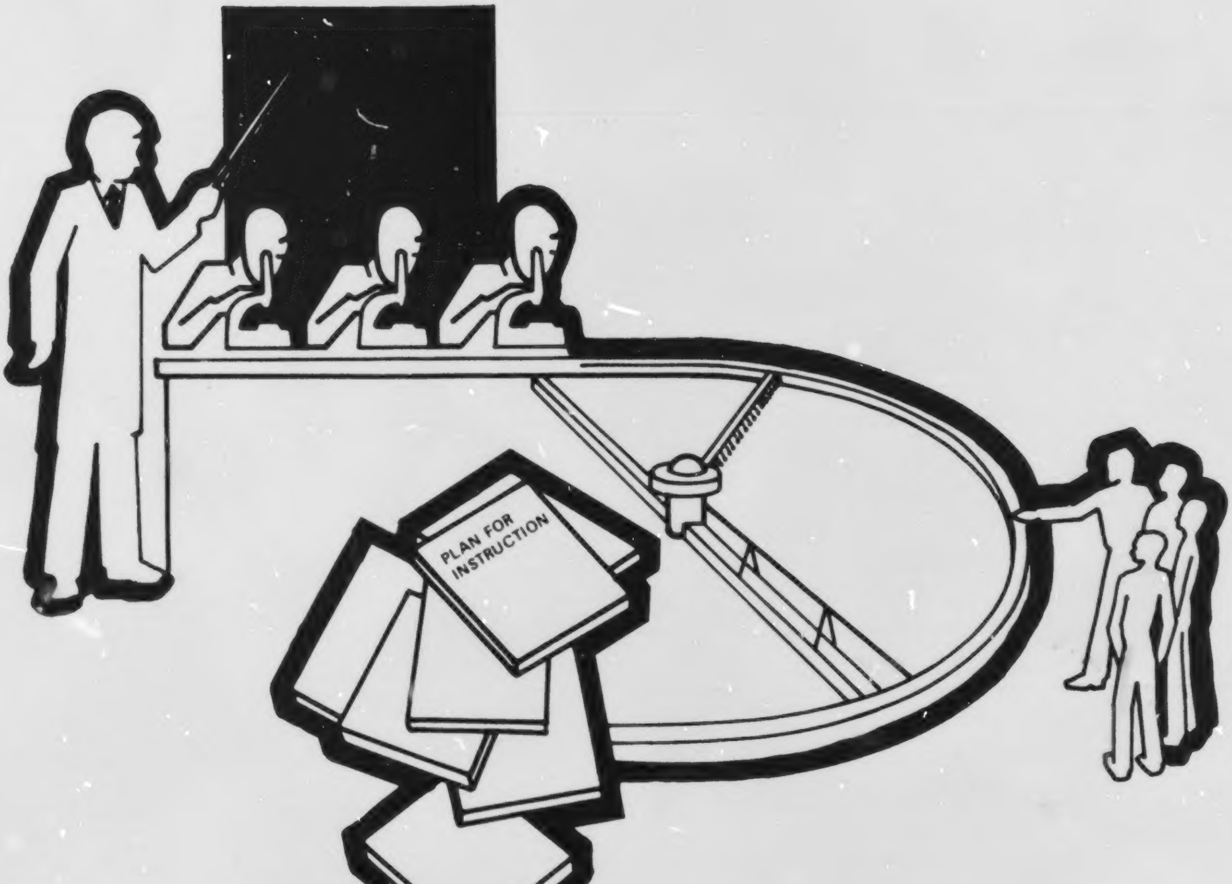

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Development and Evaluation Associates, Inc.
700 East Water Street
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FOREWORD

The Advanced Instructional Technology Workshop is the second of two workshops developed to provide environmental protection professionals with the skills needed to plan and deliver training programs. The first workshop provides a basic foundation for the subjects treated here.

Materials and directions for the advanced workshop are presented in two volumes. There is a Staff Guide intended for use by the instructor in planning and conducting the workshop. This Participant Reference Manual contains material for participants' use during the workshop. It is also intended for future use as a reference when preparing instructional activities.

OTHER U.S. ENVIRONMENTAL PROTECTION AGENCY INSTRUCTIONAL SUPPORT SERVICES AND MATERIALS

INSTRUCTIONAL RESOURCES CENTER

The U.S. EPA National Training and Operational Technology Center (NTOTC) maintains an Instructional Resources Center in Cincinnati, Ohio. A primary objective is the compilation and dissemination of information about water quality and pesticide instructional materials available to interested persons. The "Instructional Resources Center Bulletin" is designed as the communications link between the Center and persons involved in environmental education and training. If you wish to receive free copies of the Bulletin, send your name, position title, organization or institution or agency name, mailing address and phone number to:

IRC Bulletin
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

INSTRUCTIONAL MATERIALS CATALOG

Several audiovisual units and course packages are available for free loan from U.S. EPA's National Training and Operational Technology Center. The "Water Quality Control Instructional Materials" catalog describes slide/tape units, 16 mm films, videocassettes and course packages that can be borrowed. If you wish to obtain a free copy of the catalog, please send address information to:

Instructional Resources Center
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

INSTRUCTIONAL RESOURCES INFORMATION SYSTEM

The Instructional Resources Information System (IRIS) is a computer-based information system. It currently lists information about 3000 printed or audiovisual water quality and pesticide instructional resources available from various individuals, state and federal government agencies, educational institutions and commercial companies throughout the country. For more information about this system, write to:

U.S. EPA Information Dissemination Project
Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

INSTRUCTIONAL SUPPORT PACKAGES
for
TRAINING ENVIRONMENTAL PROFESSIONALS

The U.S. EPA National Training and Operational Technology Center (NTOTC) has developed instructional packages for several technical courses of interest to water, wastewater and land management personnel. Each package consists of a course manual, a staff guide and visual or audiovisual instructional aids for each topic. The printed manuals are available through EPA's Instructional Resource Information System (IRIS) and/or the National Technical Information Service (NTIS). Instructional aids for teaching the topics are available on free loan from EPA's NTOTC.

Following is a description of the courses for which instructional packages are currently available. The format of the manuals facilitates selection and presentation of those topics of interest to a particular student or group of students.

For more information about obtaining any of these materials, contact:

Instructional Resources Center
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

Self-Monitoring Procedures: Basic Laboratory Skills

For: Treatment plant personnel who are required to monitor effluent discharges and who have had little or no previous experience in laboratory work.

Topics: Review of basic mathematics including the metric system, formulas and percentage; basic chemical laboratory operations such as weighing techniques, use of equipment and preparation or reagents; basic microbiological laboratory operations. Emphasis is on practice of skills.

Time: Seventeen lessons ranging from 0.5 to 3.0 hours. Total instruction time is about 38 hours.

Effluent Monitoring Procedures: Basic Parameters for Municipal Wastewaters

For: Municipal treatment plant personnel who are required to sample, measure and analyze their discharges and who have had little or no previous experience in laboratory work.

Topics: Open Channel Flow Measurements, Biochemical Oxygen Demand, Dissolved Oxygen, pH, Fecal Coliform by MPN and MF methods, Total Residual Chlorine, Suspended and Settleable Solids, Reporting Data. Emphasis is on laboratory practice.

Time: Eighteen lessons ranging from 0.5 to 7.5 hours. Total instruction time is 30 to 45 hours.

Effluent Monitoring Procedures: Metals Analyses

For: Municipal treatment plant personnel who are responsible for performing metal analyses and have had little or no experience in laboratory work.

Topics: Various metals are used as examples of six methods used to determine metals: Boron, colorimetry; Calcium, volumetric; Copper, Magnesium, Manganese, Zinc, direct aspiration atomic absorption; Lead, extraction followed by atomic absorption; Mercury, flameless atomic absorption; Potassium and Sodium, flame photometry. Emphasis is on laboratory practice.

Time: Seven lessons ranging from 2.5 to 5 hours. Total instruction time is 20 to 23 hours.

Effluent Monitoring Procedures: Nutrients

For: Municipal treatment plant personnel who are responsible for performing nutrient analyses and who have had little or no experience in laboratory work.

Topics: Phosphorus, Kjeldahl Nitrogen, Ammonia, Organic Nitrogen (by difference), Nitrate and Nitrite Nitrogen by Cadmium Reduction. Also Chemical Oxygen Demand and Oil and Grease. Emphasis is on laboratory practice.

Time: Nine lessons ranging from 1.0 to 7.0 hours. Total instruction time is 27 to 33.5 hours.

Methods for Determination of Chemical Contaminants in Drinking Water

For: Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics: Sampling, Statistics, Quality Control, Safety, Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Fluoride, Nitrate, Organics (chlorinated Hydrocarbons, chlorophenoxys, trihalomethanes), Chlorine and Turbidity. Representative methods can be selected for the laboratory practice sessions.

Time: Fourteen lessons ranging from 1.0 to 3.8 hours. Total instruction time is 26 to 49 hours.

Determination of Residual Chlorine and Turbidity in Drinking Water

For: Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics: Compliance Requirements, Total Residual Chlorine and Turbidity. Emphasis is on laboratory practice.

Time: Five lessons ranging from 0.75 to 1.5 hours. Total instruction time is 5 hours.

Inorganic Analyses in Water Quality Control Programs

For: Chemists and technicians with chemical laboratory experience, 1 year of college level inorganic chemistry and 1 semester of quantitative analysis (or equivalent).

Topics: Sample Handling, Compliance Methodology, Safety, Analytical Techniques, Volumetric Analysis, Precision, Accuracy, Quality Assurance Programs, Acidity and Alkalinity, Total Residual Chlorine, Fluoride, Hardness, Nitrate and Nitrite Nitrogen, Total Phosphorus, Total and Suspended Solids, Specific Conductance, Turbidity. Emphasis is on laboratory practice.

Time: Nineteen lessons ranging from 0.5 to 5.25 hours. Total instruction time is 30 hours.

Organic Analysis in Water Quality Control Programs

For: Chemists and technicians with chemical laboratory experience, 1 year of college level organic chemistry and one semester of quantitative analysis (or equivalent).

Topics: Sample Handling, Compliance Methodology, Safety, Control of Analytical Performance, Spectrophotometer and Calibration Graphs, Gas Chromatography, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Chlorinated Hydrocarbons, Total Organic Carbon, Total Kjeldahl and Organic Nitrogen, Oil and Grease, Phenolics, Polychlorinated Biphenyls, Surfactants. Emphasis is on laboratory practice.

Time: Twenty-one lessons ranging from0.5 to 5.25 hours. Total instruction time is 26 to 30 hours.

Bacteriological Methods in Water Quality Control Programs

For: Bacteriologists and technicians with bacteriological laboratory experience including sample inoculations, transfers, media preparation and handling, and related skills.

Topics: Compliance Methodology; Chlorine Determinations and Turbidity; Bacterial Indicators; Equipment, Media and Solutions, Sample Volumes, Sample Collection and Test Procedures for both the Multiple Dilution Tube (MPN) and Membrane Filter (MF) methods; Statistics and Geometric Means. Emphasis is on laboratory practice.

Time: Twenty-one lessons ranging from 0.75 to 4.0 hours. Total instruction time is 28.75 hours.

Land Application of Wastes

For: Engineers, scientists, waste management specialists and other professionals with at least the equivalent of an undergraduate degree in engineering, agriculture or a related discipline.

Topics: Course integrates pertinent information from sanitary and environmental engineering, agronomy, soil science, agricultural engineering, economics and law as applicable to utilizing land for the application of various types of wastes. Lessons are: Soil as a treatment medium, Site evaluation procedures, Design approaches, Social factors, Vegetative cover, Alternative systems, Monitoring, Nitrogen management, Phosphorus management, Toxic element interactions, Organics, Legal aspects, Crop selection, Non-crop uses, Costing procedure, Water management and climate effects.

Time: Twenty-one modules ranging from 0.5 to 3.0 hours. Designed for a workshop setting of about 40 hour duration.

Note: Materials were developed by a grantee.

Erosion and Sediment Control, Audiovisual Training Program

For: Those responsible for erosion and sediment control, management, inspections or State standard development or support.

Topics: Erosion and sediment control, Soils, Rainfall-runoff relationships, Erosion and sedimentation, Plant materials, Control of runoff during construction, Vegetative soil stabilization, Stream erosion control, Temporary soil stabilization, Sediment from construction, Control planning, Wooded sites, Roles and responsibilities.

Time: Thirteen modules, self-paced. The package is designed for both self-study and for group presentation.

Note: Materials were developed by a contractor.

CURRICULUM GUIDES

Curriculum guides for training water quality control personnel have been developed by various institutions and are available for use and adaptation by others. For further information about the following, contact the source cited.

A Two-Year Water Quality Monitoring Curriculum

Source: Ulster County Community College
Attn: Professor Richard Glazer's Office
Stone Ridge, New York 12484

Wastewater Technology: A Two-Year Post-High School Instructional Program

Source: Charles County Community College
Attn: Mr. William Engel's Office
P.O. Box 910
La Plata, Maryland 20646

Wastewater Engineering Technology Program

Source: Clemson University
Attn: Dr. Joseph Allen's Office
Clemson, South Carolina 29631

Note: This is a four year program.

Bachelor of Engineering Technology Curriculum in Water Quality Management

Source: Pennsylvania State University
Attn: Dr. Charles Cole's Office
Capitol Campus, W 261
Middletown, Pennsylvania 17057

Note: This is a two + two or a four year program.

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INTRODUCTION

Workshop Goal and General Description

As part of the Environmental Protection Agency's efforts to provide environmental professionals with the skills required to plan and deliver training programs, materials and guidelines have been developed for conducting a workshop in Advanced Instructional Technology. Generally, this workshop is intended to provide further breadth and depth to certain topics which were introduced in the Basic Workshop. Furthermore, this workshop has been designed so that each topic or unit can be treated separately and thus the content of the workshop can be modified to meet the needs of a specific group of participants. For each unit, a thorough treatment of various concepts and principles is provided. Opportunities are also provided for participants to practice applying new skills and receive feedback on their performance.

This workshop consists of ten units of instruction totaling over thirty hours of classroom time. It is designed for supervisors and other personnel who are responsible for on-the-job training and/or brief seminars on work-related topics, and who have had some formal training and experience in instructional development. The workshop is intended to strengthen and expand the skills of participants in designing instructional objectives, evaluating student performance, choosing instructional methods, using instructional strategies to implement those methods, selecting or developing instructional media, adapting instructional materials to trainee needs and managing instruction in either a work environment or seminar-type situation. An overview of all the units contained in this workshop is presented in the Summary Plan of Instruction in the next page.

Use of the Manual

This manual contains four kinds of materials: Unit Overviews, Content Summaries, Assignments, and Figures. A Unit Overview is provided to describe the role of the unit within the workshop, and a brief description of its content and objectives. Content Summaries are provided, where relevant, as a formal kind of "class notes" highlighting the key points to be gained from the workshop's instructional activities. Individual assignments (consisting of readings and exercises) are included where appropriate. Certain figures or illustrations used during instruction are included for your reference. As the workshop proceeds, you may also receive a variety of additional handouts and exercises which can be included within the appropriate units of instruction.

AN ADVANCED WORKSHOP ON THE TECHNIQUES OF INSTRUCTION AND INSTRUCTIONAL TECHNOLOGY

SUMMARY PLAN OF INSTRUCTION

Unit of Instruction	Time	Method(s)	Content Outline
Unit One Introduction	1 hour	-Lectures -Assignment	-Purpose of the Workshop -Systematic approach to instruction
Unit Two Analysis	2½ hours	-Lectures -Guided discussions -Assignment	-Analysis of problems -Job and task analysis
Unit Three Designing Instructional Objectives	2½ hours	-Lectures -Guided discussions -Assignment	-Writing objectives -Types and levels of objectives -Hierarchies of objectives
Unit Four Designing Evaluations	5½ hours	-Lectures -Guided discussions -Assignments	-Principles of criterion-referenced test development -Design of written test items -Evaluating instructional activities
Unit Five Selecting Instructional Methods	2 hours	-Lecture -Demonstration -Assignments	-Types of methods -Selecting methods
Unit Six Selecting Media for Instruction	2 hours	-Lecture -Assignments -Guided discussion	-Categories of media -Selecting media -Instructional Resource Information System (IRIS)
Unit Seven Selecting Instructional Strategies	7 hours	-Lecture -Assignments -Guided discussions	-Instructional strategy components -Planning practice activities -Types of reinforcement -Motivation -Content enhancement strategies -Teaching toward the objective

Unit of Instruction	Time	Method(s)	Content Outline
Unit Eight Using and Developing Media	4 hours	-Assignments -Guided discussion	-Utilization of media in instruction -Preparing overhead transparencies
Unit Nine Adaptive Instruction	2 hours	-Lecture -Guided discussions	-Developing tutorials -Individual assignments -Individualized Learning Packages
Unit Ten Management of Instruction	2½ hours	-Lectures -Guided discussions	-Classroom management -Training in a work environment -Planning and conducting workshops

INDEX TO UNITS

UNIT ONE - INTRODUCTION

UNIT TWO - ANALYSIS

UNIT THREE - DESIGNING INSTRUCTIONAL OBJECTIVES

UNIT FOUR - DESIGNING EVALUATION

UNIT FIVE - SELECTING INSTRUCTIONAL METHODS

UNIT SIX - SELECTING MEDIA FOR INSTRUCTION

UNIT SEVEN - SELECTING INSTRUCTIONAL STRATEGIES

UNIT EIGHT - USING AND DEVELOPING MEDIA

UNIT NINE - ADAPTIVE INSTRUCTION

UNIT TEN - MANAGEMENT OF INSTRUCTION

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT ONE
INTRODUCTION

Estimated time for unit - One hour

The CONTENT of this unit:

This unit presents an introduction to the purposes and content of this workshop. The advantages of using a systematic approach to plan instruction are presented. A model of the activities involved in a systematic plan is explained. The results of these activities are described in terms of the information they provide for use in filling out planning forms such as the Instructional Package Worksheet (IPW).

The OBJECTIVES of this unit:

At the completion of this unit you will be able to:

-list the eight steps of a systematic procedure for planning and preparing instruction
-explain how the systematic process provides information useful for completing Instructional Package Worksheets.

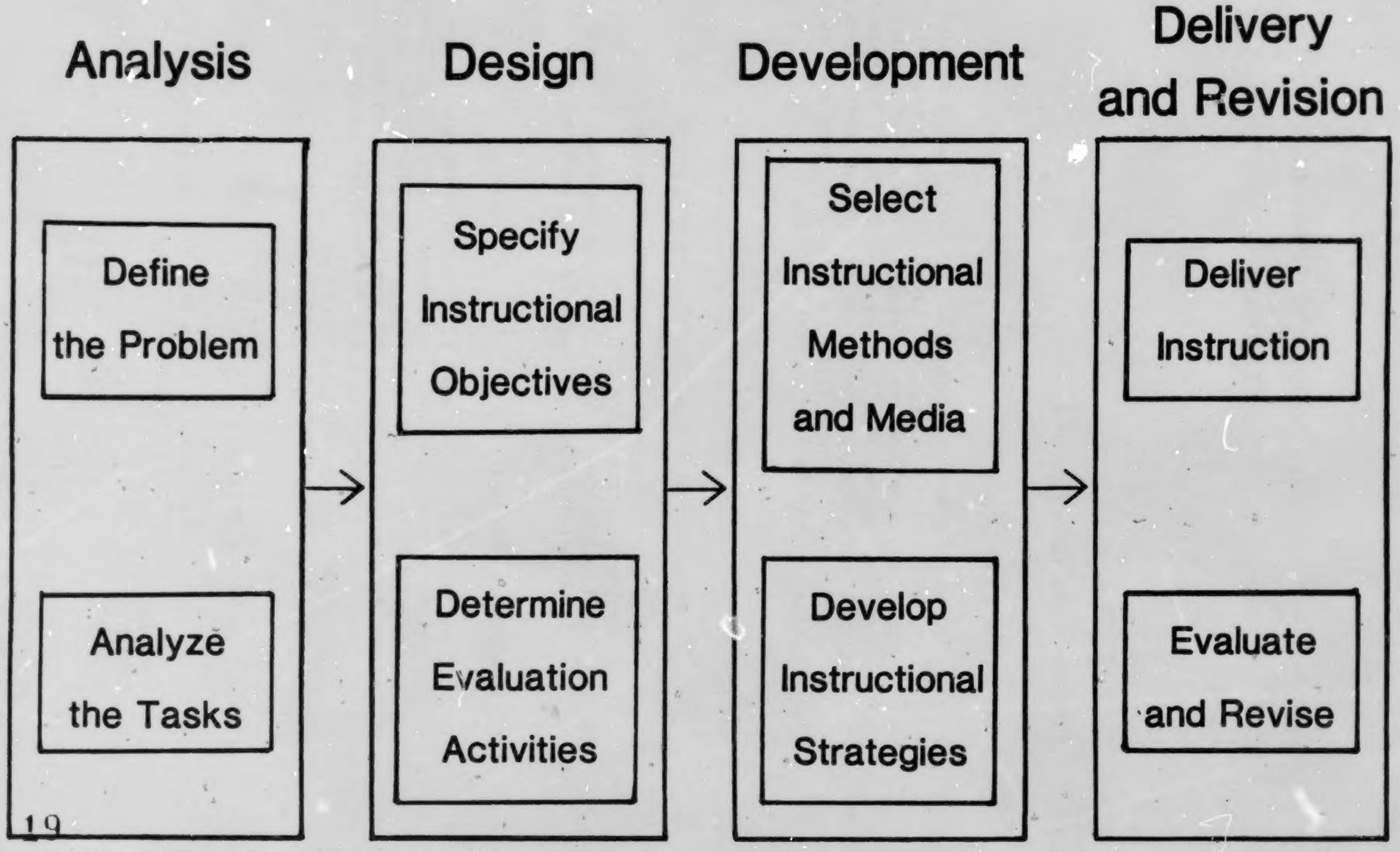
The PURPOSE of this unit:

The purpose of this unit is to explain the use of one specific model of instructional development. While it is assumed that participants in this workshop are familiar with instructional development activities, the model presented in this unit provides a systematic procedure for developing materials using Instructional Package Worksheets. This unit is included to insure a common understanding of procedures.

The RESOURCES for this unit:

1. The Instructional Development Process (model diagram)
2. Instructional Package Worksheet

THE INSTRUCTIONAL DEVELOPMENT PROCESS



Analysis
- Define the Problem
- Analyze the Tasks

Design
- Specify Instructional Objectives
- Determine Evaluation Activities

Development
- Select Instructional Methods and Media
- Develop Instructional Strategies

Delivery and Revision
- Deliver Instruction
- Evaluate and Revise

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT TWO
ANALYSIS

Estimated time for unit - Two hours thirty minutes

The CONTENT of this unit:

This unit reviews the first two steps of the instructional development process, Problem Analysis and Task Analysis. These procedures were presented in detail in the workshop, Basic Instructional Technology. The primary activity of the first lesson is an exercise in which you analyze a problem situation using the Problem Definition Worksheet. In preparation for this exercise the definition of 'problem' and of the three categories of problems are reviewed. The second lesson presents a complete step-by-step procedure for dividing the duties of a job into their component tasks, and for detailing the steps required to complete these tasks.

The OBJECTIVES of this unit:

After completing this unit you will be able to:

-define personnel performance problems in detail using the Problem Definition Worksheet.
-use the Job Task Summary Sheet and the Task Detailing Sheet to define a job in terms of its duties, their component tasks, and the steps required to complete the tasks.

The PURPOSE of this unit:

This unit provides procedures for systematically determining the nature of a personnel performance problems, the suitability of using training to resolve the problem, and for isolating the specific tasks for which the training is required.

The RESOURCES of this unit:

1. Content Summary
2. The Instructional Development Process - Analysis
3. Problem Definition Worksheet
4. Job Task Summary Sheet
5. Task Detailing Sheet

UNIT TWO: ANALYSIS
CONTENT SUMMARY

Problem Analysis

Problem

A discrepancy or deficiency between the ways things are and the ways things ought to be.

Categories of Problems

Skill or Knowledge Problems - when people do not know what to do or how to do it.

Motiviation or Incentive Problems - when people know what to do but do not care to do it.

Environmental Problems - when people cannot do something because of an obstacle in the work environment.

Task Analysis

Job

The occupational title or position held by an employee.

Job Description

A statement (or statements) outlining the areas of responsibility (duties) of a given position.

Task

Each of the skills or operations which belong to a specific area of responsibility. Each task usually consists of specific and distinct steps for its completion.

Task Analysis

The act of dividing a job into all its components. It results in a list of everything an employee must do to advance the work to completion.

Type of Behavior

Cognitive. Actions which involve knowing, understanding or applying information; remembering or using facts or ideas.

Affective. Expressions of feeling or interest; the adoption of an attitude or belief; the motivation to do something.

Psychomotor. Physical action, speed or agility; the performance of a particular body movement.

Levels of Cognitive Behavior

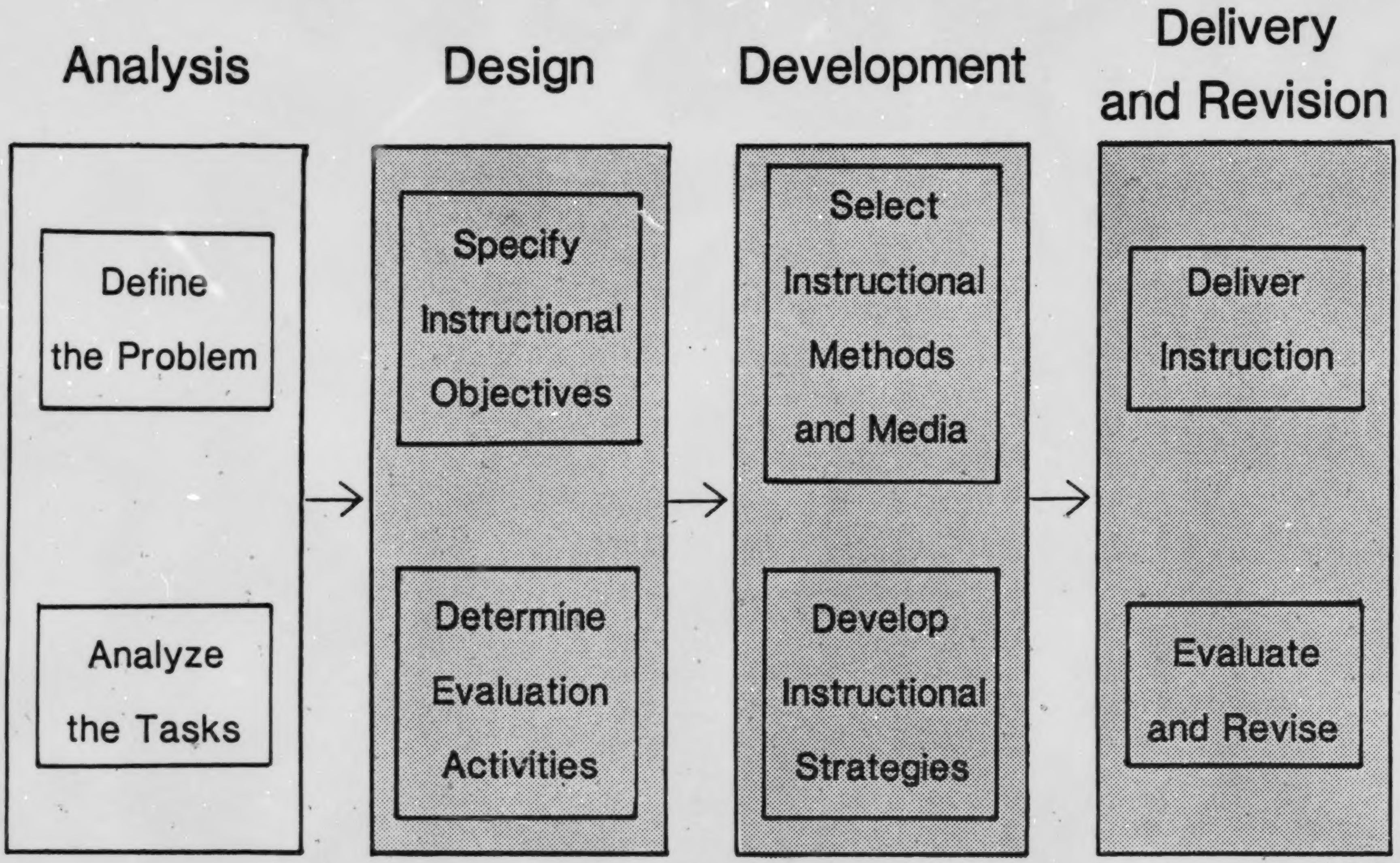
Knowledge. Ability to state a fact, symbol, definition, procedure, etc.

Comprehension. Understanding the meaning of a piece of information; ability to explain or classify.

Application. Using knowledge and comprehension to complete some activity; using a formula or rule; following a procedure.

Problem-Solving. Determining what must be done to perform some task; creating a procedure; combining rules or formulas into a new rule.

THE INSTRUCTIONAL DEVELOPMENT PROCESS



Analysis

Define the Problem

Analyze the Tasks

Design

Specify Instructional Objectives

Determine Evaluation Activities

Development

Select Instructional Methods and Media

Develop Instructional Strategies

Delivery and Revision

Deliver Instruction

Evaluate and Revise

PROBLEM DEFINITION WORKSHEET

(1) Something has caused you to suspect a personnel performance problem. What is it? Describe the problem briefly in the space below.

(2) Identify the specific employees by job or position title (not name) that are involved in or affected by the problem described above.

(3) What are the characteristics of this problem? Check as many of the following items as seem relevant.

A

___new people have been hired

___experienced people have new tasks or responsibilities

___new equipment, facilities or technology is being used

___new information exists

___output of work is low

___people cannot perform a task effectively

___people do not know how to perform a task

B

___undesirable attitudes toward work are present

___people do not seem to want to work

___there are no rewards for doing well

___employees provide poor service

___people feel that getting job done is not worth the effort

___employees rarely receive feedback on their performance

___employees are punished for poor performance

C

___everything takes too long

___there is not enough time to do the work

___equipment frequently does not work or breaks down often

___supplies sometimes run out

___new management or management policy exists

___employees rarely talk to their superiors

___weak or inefficient management is apparent

___people frequently seem to have nothing to do

(4) In which of the columns (Step 3) are most of the items you checked located?

____A? ____B? ____C?

If A, you appear to have a problem where employees lack skill or knowledge.

If B, the immediate indications are that there is a motivation or incentive problem.

If C, it is likely that you are faced with an environmental problem. (Something in the work setting is preventing people from performing effectively.)

(5) At this point, it is helpful to summarize the information gained in the previous steps. You should now be able to describe your problem in terms of WHO is affected (Step 2), WHAT is involved (Step 3), and WHY (Step 4). (You may also want to gather some further information about the specific nature of the problem at this point in order to develop more specific answers to the WHO, WHAT, and WHY questions.)

Write a clear summary of the problem in the following format:

WHO

WHAT

WHY

(If a variety of different jobs are affected by or involved in this problem, it may be useful to construct separate problem statements for each.)

(6) Is a training program a relevant solution to the specific problem defined above? Consider the following points as appropriate to the identified cause of the problem (Step 4).

-If you identified your problem as involving an employee lack of skill or knowledge, you may want to consider a training program.

-If you decided that you have a motivation or incentive problem, you may want to discuss the situation with others to insure that this problem lends itself to a training solution. (Many times a change in organizational policy or management procedures is a more effective solution.)

-If the problem seems to involve something in the work environment, it is rather unlikely that a training program is a relevant solution. (Investigate the situation further and consider direct changes in the work setting.)

Does a training program represent a relevant solution to your problem?

____ Yes ____ No

What other kinds of actions might be taken to address the problem in combination with or instead of a training program?

Additional strategies:

(7) If you are still certain that some form of training program is called for, proceed to analyze the training need for such a program using the Job Task Summary Sheet. Separate Job Task Summary Sheets must be completed for each job to be the subject of training.

JOB TASK SUMMARY SHEET

A. Job Title____

1. Describe the job in terms of its major duties (2-4) of responsibility.

A) ____
B) ____
C) ____
D)____

2. Which duties are most relevant to the problem identified in the Problem Definition Worksheet? Circle the relevant items on the list above.

B. For each duty chosen as relevant to the identified problem, prepare a list of the specific tasks which make up the activities of that duty. (Use additional pages if necessary to describe other duties/tasks.)

DUTY ____

TASKS 1) ____________________________________
2) ____________________________________
3) ____________________________________
4) ____________________________________
5) ____________________________________
6) ____________________________________
7) ____________________________________

DUTY ____

TASKS 1) ____________________________________
2) ____________________________________
3) ____________________________________
4) ____________________________________
5) ____________________________________
6) ____________________________________
7) ____________________________________

C. Should all of the tasks under each duty be considered as subjects for training programs? Circle all the tasks which require training attention, given your definition of the problem. (In deciding whether a specific task should be the subject of a training program, consider its relative importance, frequency of performance, and overall difficulty.)

D. Complete a Task Detailing Sheet for each task to be considered as the focus of a training activity.

TASK DETAILING SHEET

A. Write Job Title ______________________________

B. Write Task ______________________________

Complete steps C - F in the space below.

C. List the specific steps required to perform the task.
D. Check each step which needs to be taught.
E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.
F. For a cognitive behavior, indicate the appropriate level of performance:
    Knowledge - ability to recall information or procedures
    Comprehension - ability to explain information or procedures
    Application - ability to use information or procedures to do something
    Problem Solving - ability to develop new information or procedures

C Steps Required to Perform Task	D Needs to be Taught	E Type of Behavior: Cognitive, Affective, Psychomotor	F Level of Cognitive Behavior: Know., Comp., Appl., P. S.
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			
(9)			
(10)			
(11)			
(12)			

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT THREE
DESIGNING INSTRUCTIONAL OBJECTIVES

Estimated time for unit - Two hours thirty minutes

The CONTENT of this unit:

This unit reviews the nature and procedure for constructing specific instructional objectives. You will be able to practice writing objectives for specific tasks using information from the Task Detailing Sheet completed in Unit Two. Assignments in this unit explain how to write objectives according to a four-part format, and how to write them for the type and level of the intended behavior. The hierarchical approach to objectives specification is covered and the use of the Lesson Planning Form is explained.

The OBJECTIVES of this unit:

After completing this unit you will be able to:

- define the term "instructional objective"
- list four reasons why objectives are important
- write instructional objectives according to the four-part format
- write cognitive instructional objectives on more than one performance level
- list and describe the nature of the levels of the objectives hierarchy

The PURPOSE of this unit:

This unit has been designed to provide trainers with a straightforward and systematic method of objectives writing. Well-defined objectives help an instructor develop and organize training. They enable both the instructor and the trainee to identify the intended outcomes of the training.

The RESOURCES for this unit:

1. Content Summary
2. Assignment 3.1, Writing Instructional Objectives
3. Assignment 3.2, Types and Levels of Objectives
4. Lesson Planning Form

UNIT THREE: DESIGNING INSTRUCTIONAL OBJECTIVES
CONTENT SUMMARY

Objectives Specification

Instructional Objectives (Definition)

A statement that describes an intended outcome of instruction in terms of learner behavior. It describes what a specific group or class of students should be able to do under specific conditions and how well it must be done.

Importance of Objectives

Instructional objectives can be useful to trainers in a number of ways. They:

1. enable selection of the most appropriate lesson content for on-the-job training programs.
2. permit selection of the most suitable instructional strategy.
3. establish clear instructor and student goals.
4. provide an objective basis for evaluating instruction.

Task Analyses vs. Instructional Objectives

Task Analyses Describe:

1. Total Job Performance by Skilled Person
2. All Skills Required
3. All Job Steps

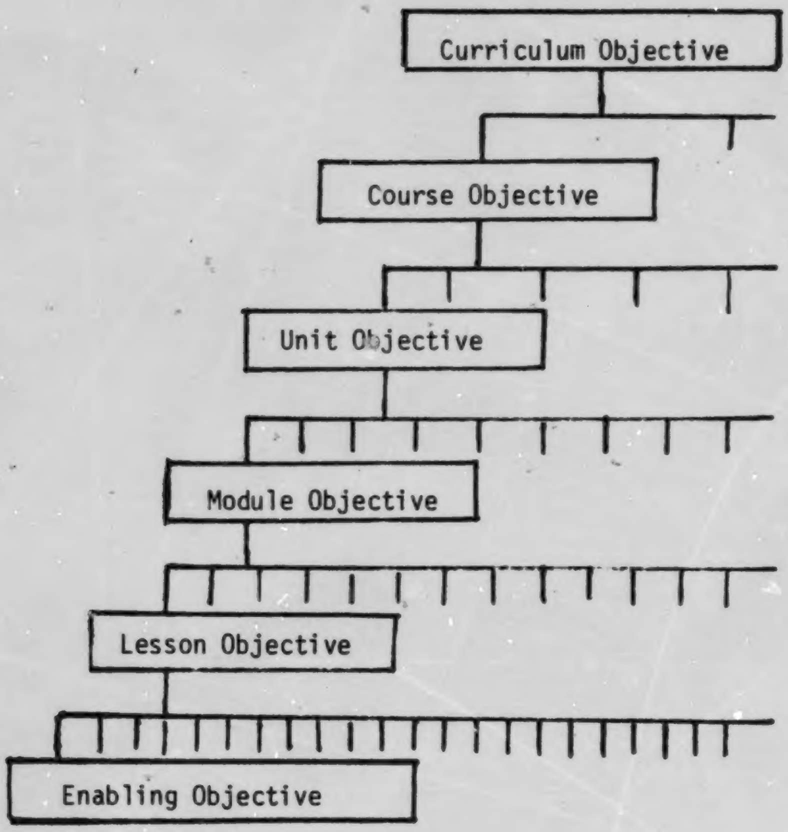
Objectives Describe:

1. Only Performance To Be Learned Through Instruction
2. Only Skills To Be Learned Through Instruction
3. Only Steps To Be Learned

Hierarchy of Objectives

Objectives may be written for a number of levels of specificity. However, there is no agreed-upon number of levels, from general to specific objectives, to serve as a guideline to the developer of instruction. One general rule when designing any training materials is to begin at the highest (most general or global) goal or objective which is being required, and identify subordinate skills which must be achieved prior to achieving the goal.

One example of a hierarchy of objectives is shown below. Each level of objectives is comprised of a larger number of subordinate skills.



HIERARCHY OF OBJECTIVES

UNIT THREE: DESIGNING INSTRUCTIONAL OBJECTIVES
LESSON 1 of 2: OBJECTIVES SPECIFICATION

ASSIGNMENT 3.1 WRITING INSTRUCTIONAL OBJECTIVES

Estimated time: Forty-five minutes

This is a self-instructional assignment. Please read the material and complete the exercises as directed.

WRITING INSTRUCTIONAL OBJECTIVES

Among the most useful educational planning devices are instructional objectives. They provide a blueprint for measuring the goals or desired outcomes of a learning experience. Instructional objectives are very useful to both the instructor and the learner for selecting or designing instruction, for directing the students' efforts to accomplish the intended objectives, and for evaluating the success of the instruction. The purpose of this module is to help you write clear instructional objectives. Read the brief description of the parts of an instructional objective given in the box below. After reviewing this description you should be able to label segments of objectives as either "audience", behavior", "conditions" or "acceptable performance" without making any errors.

INSTRUCTIONAL OBJECTIVE COMPONENTS

Instructional objectives are measureable observable goals for learning. They specify the intended outcomes of instruction in terms of the learner's behavior.

Effective instructional objectives contain the following four components:

1. Audience - who the students are or student characteristics or prerequisite competencies students should have
2. Behavior - what students should be able to do as a result of the learning experience
3. Conditions - constraints, requirements, limitations, or resources with which the behavior must be performed
4. Acceptable Performance - required level or quality of performance of the behavior

Now try the exercise on the next page.

Component Exercise

This exercise is designed to test your understanding of the four components of instructional objectives (Audience, Behavior, Conditions, Acceptable Performance). Various pieces of objectives are given below. Identify each piece in terms of the component it represents by writing the components name in the space provided.

Example: with the aid of the instruction manual conditions

1. with accuracy to four decimal places ____________
2. a chemical engineer with two years of experience ____________
3. with room temperature between 12°C and 20°C ____________
4. measure and place into the beaker ten moles of HCl ____________
5. wastewater treatment plant lab technicians with no formal training in chemistry ____________
6. with no more than three errors ____________
7. using a calculator and F tables ____________
8. weigh and record the weight of the sample solution ____________

Check your work against the answers on the next page.

Answers to component exercise

1. acceptable performance
2. audience
3. conditions
4. behavior
5. audience
6. acceptable performance
7. conditions
8. behavior

If all of your answers were correct, go on to the next page. If you missed any items, go over the material on the first page of this assignment and check to see that you understand why the answers given above are correct. Then continue.

The next four sections of this assignment describe in detail the four components of instructional objectives. Each section provides opportunities for practice in applying the various concepts which will also enable you to assess your progress.

I

Audience

Effective instructional objectives must be designed with a particular audience in mind. Not everyone needs to learn the same things. Thus, when the decision is made to plan a piece of instruction to teach a particular behavior, specific attention must be given to defining the exact nature and present capabilities of the intended students or trainees.

Failure to identify the precise audience for instruction can lead to a number of problems. The instruction might be too easy for the trainees/students who eventually use it because they have already mastered the intended objectives. On the other hand, the material might be too difficult if it assumes that the trainees already possess certain competencies which in fact they do not. The more precisely you can specify the intended audience for the instructor the better.

Audience Exercise

The audience component in each of the following objectives is not clearly defined. Underline the faulty audience component and rewrite a more appropriate audience component for the objective.

Example:

By the end of the training they will be able to collect water samples

Improved audience statement: the wastewater treatment Operator II's.

1. By the end of the fourth week of instruction, they should be able to balance 10 chemical equations with only two errors.

   Improved audience statement: ______________________________

2. Using a hand calculator and T tables, he will be able to perform a test of Pearson's correlation on two samples with 100% accuracy.

   Improved audience statement: ______________________________

3. By the conclusion of this assignment, workshop participants will be able to construct clear, effective instructional objectives.

   Improved audience statement: ______________________________

4. Through the slide-tape unit on Engineering Aspects of Water Fluoridation, you will learn to identify and properly apply necessary equipment and chemical procedures.

   Improved audience statement: ______________________________

Check your work against the suggested answers on the next page.

Audience Exercise - Suggested Answers

Listed below are possible clarifications of the audience components in the sample pieces of objectives given above. Check your efforts to clarify the audience statements against these examples. Do your audience statements seem to be as clear or specific as these? If not, why?

1. ...trainees with basic mathematical skills but no background in chemistry...

2. ...a student who has completed all of the exercises in the Basic Statistics Handbook...

3. ...workshop participants with no previous instructional experience...

4. ...operators and supervisors of water treatment plants who need to learn how to add fluorides to a water supply...

If any of your audience statements seem vague or general by comparison, clarify them before going on to the next page.

II

Behavior

The description of the intended behavior is the most critical component of an instructional objective. It should clearly define the intent of the instruction in terms of a specific capability to be possessed by those who complete the instruction. It describes what someone will be able to do.

When learning is expressed in terms of observable behaviors, the instructor accepts the trainee's performance of that behavior as evidence that the objective has been achieved. Clear behavior statements effectively answer such questions as "How will I be able to judge when the trainees understand the material?" or, "What evidence will I accept as proof that they have learned what I taught?"

Defining the intent of the instruction in terms of explicit behaviors (capabilities, competencies, or performances) is also helpful to the trainee. Clearly stated objectives enable students to identify what is expected of them and when they have accomplished it.

Failure to describe the objective using observable behaviors can result in confusion over the true purpose of the instruction and evaluation of its achievement. For example, what does it mean "to know" how to operate a piece of equipment? Does "to know" mean to describe how it operates, or to actually operate it, or perhaps even to fix it when it breaks? Simply describing an objective in such vague terms as "to know" or "to understand" does not clearly communicate the intent of the instruction. A clear and specific statement in the objective of what someone will be able to do leaves little doubt about the capabilities which the learner should possess.

Certain verbs are more useful for clearly defining observable behaviors than others. For example, while "to understand" is vague, "to construct" leaves little doubt about the intended performance. Further examples are listed below.

Vague Terms Which Refer to Unobservable Behaviors:

to know
to really know
to fully appreciate
to grasp the meaning of
to conceptualize fully
to believe in
to gain an understanding of
to concentrate on
to be mindful of
to understand

Terms Which Refer to Clearly Observable Behaviors:

to write
to recite
to draw
to dictate
to diagram
to list
to name
to construct
to perform (a test)
to trouble-shoot
to start up
to analyze
to adjust
to divert
to operate
to repair
to separate into groups
to compare and decide
to identify (circle and underline)
to measure and record

Exercise on Behavior Component

Selected fragments of objectives are listed below. Each fragment contains a more or less observable description of the intended behavior. For each of the items, complete the following activities:

1. Underline the word or words which describe the intended behavior or outcome of the instruction.
2. Decide whether the underlined word or phrase describes a specific and observable, or vague and unobservable performance. Record your decision by checking the appropriate blank on the right.
3. For each statement you identify as vague and unobservable, create a more specific statement, and write it in the space directly below the original item.

Example:	Specific	Vague
The trainee will know the fire exits for each work area. recite	___	✓
1. Fully understand the inspection procedure.	___	___
2. Use the model to demonstrate the process of lubrication.	___	___
3. Name the chemistry tests required of this plant for compliance reports.	___	___
4. Develop a working use of submerged flow rate diagrams.	___	___
5. List four operating conditions which affect the primary sedimentation process.	___	___
6. Identify (label) the sections of a Parshall Flume.	___	___
7. Perceive the differences between the calibration procedures for two applicators.	___	___
8. Measure and record the concentration of fluoride in a sample of drinking water.	___	___
9. Diagram the parts of one applicator acceptable for pest control for outdoor nursery crops.	___	___

Check your answers on the next page.

Answers to Exercise of Behavior Component

	Specific	Vague
1. Fully understand the inspection procedure.		x
Describe in writing:		
2. Use the model to demonstrate the process of lubrication.	x	
3. Name the chemistry tests required of this plant for compliance reports.	x	
4. Develop a working use of submerged flow rate diagrams.		x
Identify components using submerged flow rate diagrams.		
5. List four operating conditions which affect the primary sedimentation process.	x	
6. Identify (label) the sections of a Parshall Flume.	x	
7. Perceive the differences between the calibration. procedures for two applicators.		x
List.		
8. Measure and record the concentration of fluoride in a sample of drinking water.	x	
9. Diagram the parts of one applicator acceptable for pest control for outdoor nursery crops.	x	

Were you able to correctly identify the behavioral terms in each of the examples? Did you have any difficulty in deciding whether they were specific or vague? For those that were vaguely stated, were you able to suggest a more specific statement? If you had any difficulties, review the preceding material and try to resolve the differences between your responses and the ones suggested above before continuing.

Please go on to the next page.

III

Conditions

A third important component of instructional objectives is the description of the conditions under which the desired behavior is to be performed. That is, it is one thing to be able to describe the operation of a water treatment facility from memory, and quite another thing to describe its operation using a model of the facility. The difference between these two performances is in the conditions for the performance (from memory with no aids, as opposed to using a model). The precise nature of the intended conditions can have a major impact on the interpretation of the intended behavior. For example, it is rather unclear what is expected of a student from the statement:

Construct the Periodic Table of the Elements. The task is more clearly clearly expressed as:

Given a list of chemical symbols and their atomic structure, construct the Periodic Table of the Elements. But a rather different performance is suggested with a change in the stated conditions:

Without the use of book, notes, or other outside aids, construct the Periodic Table of the Elements.

As shown by these examples, a clear description of the conditions of the behavior's performance answers such questions as: "With what materials or assistance will the behavior be performed?" or, "Under what circumstances will the performance be evaluated?" Note that describing the conditions of performance is quite different from describing conditions of learning. That is, neither of the example objectives included a statement like, "Given a unit of instruction on the Periodic Table..." Such a statement would have described the conditions under which the behavior was learned rather than the circumstances surrounding its ultimate performance and would not have clarified the precise nature of the behavior itself. Confusing the conditions for learning with the conditions for performance is a common mistake that should be avoided in constructing good instructional objectives.

Try the exercise on condition statements on the next page.

First Exercise on Condition Statements

Review the following list of possible condition statements. Circle those statements which might be used in an instructional objective to identify the conditions for the intended behavior's performance.

1. name the hazards involved

2. after studying Chapter Three

3. with the use of a calculator

4. without the use of the Instruction Manual

5. raise the heated solution to eye level

6. in less than 30 minutes

7. graduate students in chemical engineering

8. using the computational formula and table of commom logarithms

Go on to the next page.

Answer to First Exercise on Condition Statements

You should have identified the following phrases as condition statements:

3. with the use of a calculator

4. without the use of the Instructor Manual

6. in less than 30 minutes

8. using the computational formula and table of common logarithms

If you missed any of these or chose others, reread the previous material to determine why your response was incorrect. Ask your instructor for additional help if necessary. Then, continue with the exercise on the next page.

Second Exercise on Condition Statements

Write a clear description of the conditions under which the behavior is to be performed for each of the following incomplete instructional objectives.

Example: First year biology students will label with 100% accuracy the four chambers of the heart, the aorta and the pulmonary artery.

Conditions: given a diagram of the human heart.

1. Wastewater Lift Station Maintenance Mechanic II's will diagnose malfunctions in pumping station equipment. Their diagnoses must be correct as determined by their supervisors.

   Conditions: ____________________

2. Sewage Treatment Technology students will describe what happens during each of the major stages of biological treatment.

   Conditions: ____________________

3. Students enrolled in the course "Water Supply Studies" will state the maximum acceptable nitrate content allowed in drinking water according to the Safe Water Drinking Act.

   Conditions: ____________________

4. Weed Control Farm Advisors will be able to calculate the standard deviation of field sample particulate densities.

   Conditions: ____________________

Check your work against the suggested responses on the next page.

Suggested Responses to Second Exercise on Condition Statements:

1. Given a faulty piece of equipment, its service manual, and the lift station tool set.

2. In no more than five minutes given a list of the stages of biological treatment.

3. Without the use of books, charts, notes, or other aids.

4. Given the density measures of the samples collected.

Your answers may be different from the ones suggested here. To be considered correct, your answers must:

1. Specify the conditions under which the performance is to be evaluated; and
2. not describe the conditions under which the behavior was learned.

Note: It is not necessary to list trivial conditions such as "Given a pencil, blank paper, a desk, chair, etc."

If any of your condition statements seem vague or general by comparison, clarify them before going on to the next page.

IV

Acceptable Performance

The acceptable performance of an effective instructional objective is the degree to which the intended audience performs the desired behavior. It is the standard of performance for considering an objective as successfully completed.

The degree of acceptable performance will differ according to the type and importance of the objective of which it is part. Students learning the names of the fifty states may not be required to list every state from memory. However, a surgeon is expected to perform every step of an operation without error.

Acceptable Performance Exercise

Write a clear description of the degree of acceptable performance required for each of the incomplete objectives below:

1. Given appropriate record sheets Operator I's, while on the job, will read and record all meter levels associated with a specific piece of equipment.

   Acceptable Performance ____

2. Given a faulty water meter, the maintenance staff member will diagnose the problem and repair the meter.

   Acceptable Performance ____

3. Given a blank discharge monitoring report form, the operations log book, and the laboratory record book, the plant superintendent will be able to make the necessary calculations and record the required data on the form.

   Acceptable Performance ____

4. Given a copy of the plant layout, Operator Trainees will identify (by circling) the location of pressure gauges to be checked during rounds.

   Acceptable Performance ____

5. Given a description of a major equipment malfunction, a shift foreman will list the emergency procedures to be followed.

   Acceptable Performance ____

Now check your answers on the next page.

Suggested Answers to Acceptable Performance Exercise:

1. All readings will be recorded at the proper place on the form and will be correct ± 2%.

2. The repaired meter will be in 100% working order.

3. The form will be completed within sixty minutes and will contain no errors.

4. Without error.

5. All procedures will be included and they will be listed in sequential order.

Your answers may be different from the ones suggested here. To be considered correct, your answers must specify the degree or standard of performance which is to be an acceptable evidence that the instructional objective is successfully completed.

If any of your performance statements seem vague or general in comparison to the suggested answers, clarify them.

Then go on to the next page.

SUMMARY

Instructional objectives represent the instructor's goals or desired outcomes for the learning experience. Effective instructional objectives can be very useful to the instructor for the selection and designing of instruction, learning materials and tests, for evaluating the success of instruction, and for directing the student's efforts. Students find instructional objectives useful to direct their learning and to know exactly what performance is required. It is very important, if the instructor's desired outcomes are to be realized, (1) that the objectives are appropriate for the particular audience, (2) the performance which demonstrates the desired outcome be specified in terms of observable behavior, (3) intended performance conditions be clearly communicated, and (4) the degree of acceptable performance be specified.

All components of the instructional objective need not always be written when the instructor is certain there is no misunderstanding. These components should be viewed only as guides or aids for the instructor in his/her management of the learning process. Clear, effective instructional objectives offer students not only enhanced learning but also positive experiences since unclear directions and misunderstandings are minimized.

UNIT THREE: DESIGNING INSTRUCTIONAL OBJECTIVES
LESSON 1 of 2: OBJECTIVES SPECIFICATIONS

ASSIGNMENT 3.2 TYPES AND LEVELS OF OBJECTIVES

Estimated time: Thirty minutes

> This is a self-instructional assignment. Please read the material and complete the exercises as directed.

TYPES AND LEVELS OF OBJECTIVES

In Unit Three's introduction to the Task Detailing Sheet, the concepts of type of behavior and level of cognitive behavior were introduced. It was explained that the performance of various steps of a task may require very different types of behavior (cognitive, affective, or psychomotor), or represent a particular level of cognitive behavior (knowledge, comprehension, application, or problem solving). The particular type and level of behavior called for in a step's performance must be considered in designing effective training on that step. Good instructional objectives are written so as to clearly indicate the type and level of behavior being taught.

This assignment reviews the key concepts and provides practice in constructing objectives for different types and levels of cognitive behaviors. (An emphasis is placed on cognitive objectives since they are the most common and important learning outcomes for training programs designed to address skill or knowledge problems.)

Types of Behavior and Instructional Objectives

Cognitive behaviors involve knowing, understanding, or applying information or procedures. This workshop is almost totally concerned with providing training in the cognitive behaviors required to plan and conduct instruction. Excerpts from some of the workshop's objectives addressing cognitive behaviors are listed below.

"...participants will be able to list the phases of a systematic approach to instruction and explain each briefly..."

"...participants will be able to plan and construct simple written tests..."

"...participants will be able to identify appropriate uses of audiotapes..."

Affective behaviors involve feelings and attitudes towards something. They include expressions of interest, the adoption of an attitude or belief, or the motivation to do something. Affective behaviors can have an important influence on how a particular job or task is performed. Excerpts from sample instructional objectives which address affective behaviors follow.

"...participants will express increased interest in learning procedures for planning effective instruction..."

"...participants will feel more at ease speaking in front of a group..."

Psychomotor behaviors involve physical action, the performances of a particular body movement. Psychomotor behaviors become the focus of training activities when a particular task requires physical agility, speed, precision, or coordination. (While cognitive or affective behaviors may also be involved, the primary behavior of interest is a physical action.)

Examples of psychomotor behaviors are:

"...speakers should maintain eye contact with audience..."

"...speakers will vary their volume level and tone of voice..."

"...speakers should not exhibit any distracting mannerisms..."

Many activities involve all three types of behavior to some degree. Even a simple task like "check the filter" requires that the employee knows what is to be done (cognitive), chooses to do it (affective), and physically removes and inspects the filter (psychomotor). However, in most training situations it is readily apparent that one type of behavior is the major concern. In this example, the primary emphasis would be on the cognitive behavior of knowing to check the filter (probably as one step in a larger maintenance task).

For most of the training programs you will be concerned with, the instructional objectives will typically address cognitive behaviors. Sometimes they may involve affective behaviors. Only rarely will a psychmotor behavior be the target of instruction. (Most required psychomotor behaviors, like the use of a screwdriver, are simply assumed to be a basic entering competency for anyone holding a job.)

Exercise on Identifying Instructional Objectives by Type of Behavior

Read the following objectives and, for each, decide whether the concern is with cognitive, affective, or psychomotor learning. Indicate your decision by labeling each objective by type of behavior in the blank on the right.

1) As a result of this public awareness campaign, visitors to state parks will come to value an unpolluted environment as shown by an increased effort to keep the park free of debris indicated by an observable decrease in litter and increase in the amount of trash in receptables.

Type of behavior?______________________

2) Through this program, trainees will learn to write instructional objectives which clearly specify the intended audience and behavior and the conditions and nature of the acceptable performance. The ability to construct such objectives for training in work-related tasks will be evaluated through peer review of various exercises using the rating form provided.

Type of behavior?______________________

3) As a result of the redesigned materials, plant mechanic trainees will maintain a higher level of interest in the training program as demonstrated by decreased absenteeism and increased participation in optional activities.

Type of behavior?______________________

4) The Advanced Workshop will enable environmental faciltiy operators with some previous instructional experience to apply a systematic model for planning and delivering instruction. Achievement of this objective will be evaluated in workshop exercises which require participants to design and deliver an actual lesson. The quality of that performance will be evaluated using specially designed rating scales.

Type of behavior?______________________

Check your answers on the next page.

Answers to Exercise on Identifying Instructional Objectives by Type of Behavior

1) Affective behavior

2) Cognitive behavior

3) Affective behavior

4) Cognitive behavior

If you failed to properly identify any of the four objectives, reread the preceding material and reconsider your answer(s). Talk to your instructor if you have any particular questions.

Levels of Cognitive Objectives

As originally explained in Unit Three, there are four levels of cognitive behavior as follows:

I) Knowledge - the ability to state a fact, describe a symbol or repeat a definition.

II) Comprehension - the ability to explain or classify procedures or information.

III) Application - the ability to apply an existing knowledge or comprehension of something to conduct some procedure or derive information.

IV) Problem-Solving - the ability to invent new information or procedures based on past experience.

The four levels are listed in order from the simplest to the most complex forms of cognitive behaviors. Each advanced level assumes the possession of preceding levels of behavior. Thus, problem-solving activities require that the relevant facts or procedures are known (Level I), understood (Level II), and can be properly applied (Level III) to the new situation.

When "cognitive behavior" is the focus of instruction, it is important that the objective specifies the precise level of behavior desired. The design of the training activities will vary greatly depending on the level of cognitive performance required. For example, it is one thing to teach someone to name the parts of a piece of equipment (Level I), and quite another to prepare him/her to "trouble-shoot" problems in the operation of that equipment (Level IV).

One way to insure that an instructional objective specifies the desired level of cognitive performance is to carefully consider the verb used to describe the behavior. Different verbs naturally refer to different levels of cognitive performance. The list on the next page provides some example verbs for describing each level. Read the list carefully and notice how the level of behavior suggested by the verbs changes from column to column.

USEFUL VERBS FOR EXPRESSING COGNITIVE BEHAVIORS IN WRITING INSTRUCTIONAL OBJECTIVES

Knowledge

- draw
- duplicate
- find
- gather data
- identify
- label
- list
- match
- repeat
- recognize
- state

Comprehension

- classify
- categorize
- cite evidence for
- compare
- contrast
- define
- describe
- differentiate
- discriminate
- distinguish between
- explain
- give examples of
- illustrate

Application

- analyze
- calculate
- compute
- conduct a test
- construct
- estimate
- install
- interpret
- manipulate apparatus
- measure
- organize data
- plot a graph
- prepare
- produce
- prove
- reformulate
- relate
- specify limitations and assumptions

Problem-Solving

- create
- develop
- devise a method
- discuss critically
- evaluate
- formulate hypotheses
- generalize from data
- infer
- integrate
- invent a new solution
- manipulate ideas
- plan
- predict
- propose reasons and defend them
- reorganize
- solve a problem
- synthesize

Exercise on Identifying Levels of Cognitive Behaviors

Read the following objectives and, for each, decide whether the specified cognitive behavior is at the knowledge, comprehension, application, or problem-solving level. Indicate your decision by labeling each objective by level of cognitive behavior in the blank on the right. (You may want to refer to the verb list on the preceding page if you have any difficulty deciding on the level.)

1) The activities of this lesson will enable participants to identify various important variables in the physical and interpersonal environment of the classroom. . .

Level of cognitive behavior?____________________

2) By the conclusion of this lesson, participants will be able to define all of the principles for designing good instructional graphics when given the names of those principles in a brief exercise.

Level of cognitive behavior?____________________

3) Working with the task analysis and objectives developed as parts of previous units, participants will learn to plan an evaluation and offer explanations for their decisions.

Level of cognitive behavior?____________________

4) By the conclusion of this lesson, participants will be able to define the concepts of "job," "task," and "task analysis" from memory. . .

Level of cognitive behavior?____________________

Check your answers against those on the next page.

Answers to Exercise on Identifying Levels of Cognitive Behaviors

1) Knowledge

2) Comprehension

3) Problem-Solving

4) Comprehension

If your answers do not agree with these, reread the previous section and check to see that you understand the concepts involved. You may wish to discuss this material with your instructor.

Exercise on Writing Instructional Objective for Different Levels of Cognitive Behavior

Using specific tasks from your own job, write two complete instructional objectives for each level of cognitive behavior. (It may be useful to refer to the list of verbs again.)

You will hand this exercise in to your instructor for his/her review. Your instructional objectives will be evaluated on the extent to which they contain clear descriptions of the audience, behavior, conditions, and degree. Use additional paper if necessary.

Tasks for which objectives are to be written.

Knowledge 1.
2.
Comprehension 3.
4.
Application 5.
6.
Problem-Solving 7.
8.

Knowledge Level Objectives:
1)

2)

Comprehension Level Objectives:
3)

4)

Application Level Objectives:
5)

6)

Problem-Solving Level Objectives:
7)

8)

Optional Exercise

If there is time remaining, you may wish to try writing affective and psychomotor objectives on some subject or area familiar to you. These objectives should contain the same four components of any good instructional objective. Hand your objectives in to the instructor for his/her review.

LESSON PLANNING FORM

Job Title____________________ Task____________________

Step____________________

Type and Level of Behavior____________________
(as appropriate)

1) Instructional Objective:

Audience ____________________

Behavior ____________________

Conditions ____________________

Acceptable Performance ____________________

2) Entering Competencies: ____________________

3) Evaluation Activities: ____________________

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s)____________________

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1.____________________

2.____________________

3.____________________

Figure 3.4/Lesson Planning Form

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT FOUR
DESIGNING EVALUATIONS

Estimated time for unit: Five and one-half hours

The CONTENT of this unit:

Evaluation activities support training efforts in many ways. This unit focuses on two of the most important, but quite different, functions that evaluation can serve: the assessment of trainee achievement and the evaluation of instructional effectiveness.

The content of this unit reviews the design of written tests, checklists and rating scales, and then focuses on the nature and use of criterion-referenced tests. Practice in the design of test items is provided. Finally, consideration is also given to techniques for evaluating the effectiveness of training materials and programs.

The OBJECTIVES of this unit:

By the conclusion of this unit, you will be able to:

-describe the use and characteristics of simple written tests, checklists and rating scales for evaluating trainee performance
-describe the use of criterion-referenced testing in assessing training outcomes
-construct a Table of Specifications for a criterion-referenced test
-construct multiple choice and short answer test items
-explain the use of several techniques for evaluating instructional effectiveness

The PURPOSE of this unit:

This unit is intended to provide you with fundamental skills in two different uses of evaluation: assessing trainee performance and evaluating the effectiveness of the instructional program. The purpose of instruction in each of these areas can be described briefly as follows:

1) For job-training activities, it is of fundamental importance that either/or both the trainer and the trainee are able to assess the trainee's progress towards specific instructional

objectives. Properly constructed criterion-referenced tests provide the best means of gathering this kind of performance information in the classroom.

2) The final step in any systematic approach to training involves gathering evaluation data on the instructional effectiveness of the training activity in order to revise and improve future training activities. This lesson introduces the concepts and techniques of this kind of evaluation activity.

The RESOURCES for this unit:

1. Content Summary
2. Figure 4.7/Example Check List
3. Figure 4.8/Example Rating Scale
4. Assignment 4.1/Preparing Criterion-Referenced Tests
5. Assignment 4.2/Exercise in Constructing Criterion-Referenced Tests - Part I
6. Assignment 4.3/Constructing Multiple-Choice Items
7. Assignment 4.4/Constructing Short-Answer Items
8. Assignment 4.5/Exercise in Constructing Criterion-Referenced Tests - Part II
9. Example Questionnaires for Evaluating Instructional Activities
   - -Handout 4.1/Participant Questionnaire
   - -Course Evaluation Questionnaires (for Lecture, Laboratory or Seminar Courses)

UNIT FOUR: DESIGNING EVALUATIONS
CONTENT SUMMARY

Introduction

Evaluation

Defined as the activities of gathering information for making decisions.

Training-Related Uses of Evaluation

-To determine the existing capabilities of employees

-To provide feedback to trainees

-To certify employee competencies

-To determine the effectiveness of training activities

Written Tests

Use

-to evaluate knowledge of facts, understanding of ideas, problem-solving skills

Types

-short answer
-multiple choice
-true/false
-essay

General Rules for Test Item Construction

Test items

1) Should be clear
2) Should be uncluttered
3) Should be functional
4) Should be at proper level of difficulty
5) Should call on desired behavior
6) Should thoroughly sample that behavior
7) Should provide a positive test of that behavior
8) Should have clearly correct answers
9) Should not "give away" answer
10) Should not "give away" answers to other items

Checklists and Rating Scales

Use

- to evaluate on-the-job performance of a particular task, skill or procedure

Nature

- Checklist: a list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job.
- Rating Scale: a list of skills or tasks with each so carefully defined as to permit judgments as to the relative quality of the trainee's performance

General Rules for Constructing Checklists and Rating Scales

- Define behavior to be evaluated at appropriate level of detail
- Determine standard for judgment of "good" performance
  - simple presence or absence of behavior? Use check list.
  - rating the relative quality of behavior? Use rating scale.

Criterion-Referenced Testing

Nature of Criterion-Referenced Testing

Tests can be used to:

- determine entering competencies
- assess progress
- certify achievement
- rank or grade students
- provide opportunities for trainees to practice using or apply some skill

Two major approaches to test design:

1) Norm-referenced tests
   - compares the performance of students
   - useful for deciding which students can perform better than others

2) Criterion-referenced tests
   - compares the performance of students against a specified objective (or criterion) that defines the nature of the desired performance
   - useful for determining the competence of each student

(but is not intended to grade or rank students one-to-another)
-the appropriate form of testing when the concern is with the trainee's ability to do the job

Requirements of criterion-referenced testing

1) Desired competencies defined
2) Behaviorally-stated objectives
3) Clear level of minimum required performance
4) Representative sample of performance
5) Test behavior matches real behavior
6) Clear report of results

Preparing criterion-referenced tests (see Assignment 4.1)

Use of criterion-referenced tests

-To determine entering competencies
-To assess progress
-To certify achievement
-To rank or grade students
-To provide practice

EXAMPLE CHECK LIST: FOCUSING THE MICROSCOPE

Directions: Check each item only if performed properly. Check final square when each step has been performed properly and in correct sequence.

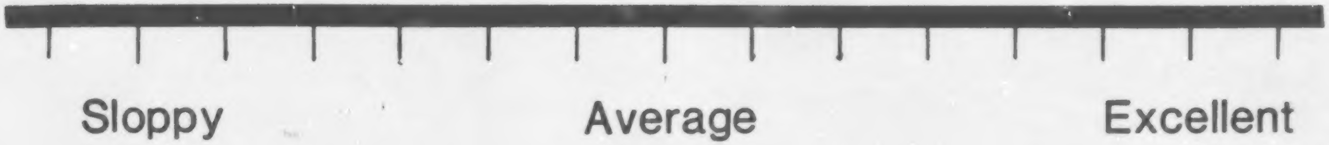
1. Snap low power objective into place ☐
2. Adjust mirror ☐
3. Assume starting point for focus ☐
4. Place slide on stage ☐
5. Adjust coarse adjustment screw to focus ☐
6. Change to high power ☐
7. Identify image on slide ☐
8. Correct sequence ☐

Figure 4.7/Example Check list

EXAMPLE RATING SCALE: WORKMANSHIP

Directions: Place an X on the line at the point which best describes this person on each dimension. You may check anywhere along the line.

1) Quality of Work



2) Care of Tools

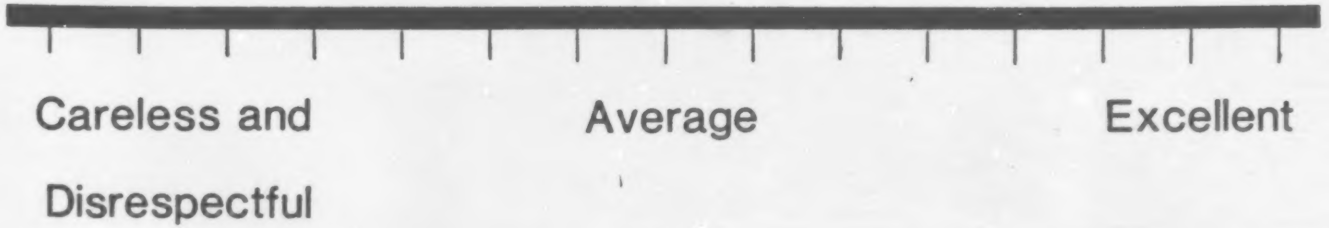


Figure 4.8/Example Rating Scale

UNIT FOUR: DESIGNING EVALUATIONS
LESSON 1 of 4: CRITERION-REFERENCED TESTING

ASSIGNMENT 4.1: PREPARING CRITERION-REFERENCED TESTS

Estimated time: 30 minutes

The following reading material describes a process for preparing criterion-referenced tests. Knowing how to prepare these tests will also give you a fuller understanding of the nature and use of the tests themselves. A complete example of the use of this process to develop a criterion-referenced test is also presented. This assignment provides the basis for later exercises in which you will have an opportunity to prepare your own criterion-referenced test.

OBJECTIVE: By the conclusion of this assignment, you will be able to describe in your own words the nature of criterion-referenced tests and a process for their preparation.

EVALUATION: You may be asked to describe the steps in preparing a criterion-referenced test in class and in the next assignment you will begin constructing your own test.

DIRECTIONS: 1. Read the following material carefully. Call upon the instructor for help if any sections are unclear.

2. You have 30 minutes to complete the reading, after which the instructor will hold a brief discussion to review the main points and concepts.

Introduction

Design and use of criterion-referenced tests involves a number of activities and decisions on the part of the instructor. These activities and decisions can be organized into a seven-step procedure for criterion-referenced testing. Each step is fairly straightforward and when completed as described here should provide you with a testing instrument that will enable you to accurately assess trainee competence in a given area.

The steps of the criterion-referenced testing procedure are explained below in terms of the key questions that must be answered or activities completed at each step. General explanations of the nature of the steps and how to complete them are also provided. After all seven steps have been presented, an example is given of their application in the design of a criterion-referenced test. Later assignments will give you an opportunity to practice application of this procedure.

Step 1: Deciding What to Test

Quite obviously, the first step in designing any test involves deciding on what is to be tested. Three separate questions must be answered in order to completely define the subject of the test. (This information then plays a major role in the conduct of Step 3.)

What areas of trainee competencies should the test be designed to assess? A criterion-referenced test is designed to reflect the specific content of the training program which it accompanies. The test should, therefore, cover the same things as the training program. In other words, the content of the test is specified by the objectives of the training program.

What kind of performance is required? Criterion-referenced tests should be designed to test the same behavior called for by the objectives. That is, the kind of behavior called for in the testing situation should match the kind and level of behavior called for in the objectives. In training programs designed with properly stated behavioral objectives, the kind (cognitive, affective, or psychomotor) and/or level of cognitive behavior is clearly specified by the objectives themselves. (See Unit Three of this workshop for further explanations of the varying kinds and level of behavior.)

How much should the test cover? It is traditional to think of designing a test to "cover" so much material, or so many hours of instruction. In criterion-referenced testing, however, the coverage of the test is determined by the natural subdivisions of the competencies which comprise a job or task. In relatively simple training situations, the test should focus on the complete set of skills relevant to a particular job. For more complicated and lengthy training situations, it is generally advisable to test trainee performance on each major set of competencies comprising the performance of the total job. Specifically, in a systematically designed training program utilizing behavioral objectives derived from a task analysis, the placement and coverage of tests is suggested by the hierarchical ordering of objectives into lesson and units.

Step 2: Setting Performance Standards

At this point in planning a criterion-referenced test, you have a clear outline of what specific competencies the test will be designed to measure. The next step is to decide on how well the trainee must perform on the test in order to be judged as possessing the desired competency. That is, how many correct responses will the trainee have to make to be considered competent? (This question is stated in its more general form below.)

It is interesting to note that this particular step in test design is unique to criterion-referenced tests since traditional norm-referenced tests use the performance of the total group to determine the relative quality of the performance of any one trainee.

How well should trainees perform on the test to be judged as possessing the desired competency? In answer to this question, you should specifically be able to say that 70% correct or 9 out of 10 items properly completed on the test will constitute a sufficient demonstration of trainee mastery of some skill to be certified as adequately proficient in that skill. The difficulty comes in determining just how much is enough. Is a performance standard of 70% correct "good enough" or should it be 90%? Two considerations must be taken into account in deciding upon the proper standard of performance.

The first consideration is the nature of the subject of training. Some skills simply require a higher level of performance (or tolerate fewer mistakes) than others. For example, a pianist who only hits 9 out of 10 notes correctly would not be considered a very good musician. Similarly, it is rather meaningless to consider a minimum standard of competency for a surgeon - the nature of the task demands nothing short of perfection. Therefore, in setting a standard of performance on a test you must first consider the extent to which the possibility of less than perfect performance can be tolerated.

A second consideration involves the difficulty of the test itself. Tests may be relatively harder or easier depending on their length and type of item or performance required. For example, there is a considerable difference in the difficulty of obtaining 100% correct on a short test with 10 true-false items and 100% correct on a test with 200 multiple-choice items. Other things being equal, of course, the longer and more difficult a test is, the more likely it is to provide an accurate assessment of trainee competence. However, the standard of performance should be adjusted to realistically reflect test difficulty. As a "rule of thumb", the shorter a test is, the higher the required standard of performance should be. Furthermore, a test composed of true-false items should require a higher standard of performance (e.g., 90% correct) than a test composed of multiple choice items (e.g., for the same-length test, 85% correct). Finally, a test composed of multiple choice items should require a higher standard of performance than one based on short answer items.

Thus, the final answer to the question of how well a trainee should perform to be judged as competent is based on careful judgment of the importance of the skill being learned and the difficulty of the test. Some guidance is provided by the findings of educational researchers who suggest that a performance standard of 80 - 85% correct on a series of ten or more items is a realistic minimum in most situations. This standard should be raised to 90% or higher for skills where near perfect performance is required.

Step 3: Defining the Sample of the Performance to be Tested

In most training situations, it would be impractical to test trainees on every instance of every objective. Therefore, most tests focus on only a sample of the actual behavior desired. The decision facing the test designer at this point is then one of identifying an appropriate sample of the behavior or competencies to be assessed on the test. This information will then provide the basis for writing the items themselves.

What is an appropriate sample of the behaviors for which we wish to test? An "appropriate" sample is one which is sufficiently inclusive and representative of the total set of skills or competencies under consideration such that a trainee's performance on the test can be reasonably assumed to reflect the trainee's potential performance on the total set of skills. To determine the precise nature of the appropriate sample, information from Step 1 on the nature of the behaviors and coverage of the test is used to construct a Table of Specifications.

The first step in constructing a Table of Specifications is to list the training objectives down the left side of a table constructed as shown.

Table of Specifications

Type and Level of Objective / Specific Objective	Cognitive-Knowledge	Cognitive-Comprehension	Cognitive-Application	Cognitive-Problem Solving	Affective	Psychomotor	Total Items
(First Objective)							
(Second Objective)							
(Third Objective)							
(Fourth Objective)							
(Etc.)							
Total Items							

Across the top of the table (as column headings) are all the various types and levels of behaviors that could apply to a particular objective. The second step is to match each objective against the type and level of behaviors indicated and cross out all the cells that do not apply. This step requires careful judgment on the part of the test designer because unless the objectives have been very precisely defined, most will contain (or imply) several levels or types of instructional outcome. For example, the objective for this lesson given in the instructor's Staff Guide states that:

> By the end of this lesson, participants will be able to describe the use and complete the design of criterion-referenced tests for basic training activities.

This objective and its accompanying instruction indicates a concern with knowledge, comprehension and application level cognitive behaviors.

On the next page is an example Table of Specifications filled out for a test on the first two lessons of this unit. Note how the objectives have been listed on the left and many of the cells crossed out as irrelevant. You will also find that each remaining cell has been filled in with a specific number of test items. Establishing the number of test items in each cell comprises the final step in completing the table and selecting the behaviors to be sampled on the test.

To complete the table, then, it is first necessary to decide upon the precise number of items to be used to sample trainee performance within each cell of the table. To do this, you must first estimate the total number of items to appear on the test (this number can be revised later if necessary). Generally, the more important the test, the greater the number of items. The number of total items is then placed in the lower left cell of the table (see Example Table).

The second decision is to allocate the total number of items on the test across the various objectives to be tested. By considering the relative importance of the objectives the number of items to be constructed for each objective is indicated in the cells of the left-hand column.

Finally, with a set number of items specified for the testing of a given objective, the final decision involves allocating the items across the cells for the type and levels of behavior comprising the objective. In dealing with cognitive objectives, it is generally best to allocate more items to the higher level behaviors (e.g. application and problem-solving) than the lower ones. (To complete the table, the cells can be totalled by column to give another kind of indication of the sample of items in the test as distributed by type and level of behavior across all objectives tested).

Step 4: Developing Test Items

The content of the test has now been fully defined in terms of the sample of behaviors to be tested. What the Table of Specifications does

Example Table of Specifications

For Test on First Two Lessons of Unit Four

Type and Level of Objective Specific Objective	Cognitive-Knowledge	Cognitive-Comprehension	Cognitive-Application	Cognitive-Problem Solving	Affective	Psychomotor	Total Items
1) Describe use and characteristics of simple tests, checklists and rating scales.	3	3	4				10
2) Describe the use and complete the design of criterion-referenced tests for basic training activities.	2	3	10				15
TOTAL ITEMS	5	6	14	---	---	---	25

not do is prescribe the nature of the test items themselves. Two questions need to be addressed here to provide the proper guidance for developing the test items.

What type of test item should be used?

The four most common forms of test items are short-answer, essay, multiple-choice and true-false. Of these four, only short-answer, multiple-choice and true-false are considered appropriate for criterion-referenced tests. Essay items are difficult to score and since different scorers may not agree on the nature of the correct answer, they are not useful as objective items for testing purposes. (Furthermore, the quality of a trainee's performance on an essay test may not reflect mastery of the intended subject matter so much as the verbal ability of the person being tested.)

Of the remaining three types of items, short-answer items are most appropriate for higher-level cognitive objectives where the emphasis is on the trainee's ability to complete some procedure or piece of reasoning in order to supply or develop the correct answer. Short-answer items can also be useful for lower level cognitive behaviors (such as defining or describing) where it is important that the trainee be able to express the answer in his/her own words.

Multiple-choice and true-false items are the easiest items to score since the answers are all prespecified. They are typically used to measure performance of relatively simple skills, but when properly designed they can be used to measure higher levels of cognitive performance. However, multiple-choice and true-false items are always "easier" for the trainee to complete by comparison to short-answer items on the same subject. Furthermore, multiple-choice and true-false items are subject to a certain amount of guessing.

How difficult should the items be? The difficulty of the items should match the difficulty of the actual, desired on-the-job performance as closely as possible. (Contrary to traditional norm-referenced tests, criterion-referenced tests do not require a range of hard, moderate, and easy items with which to "spread out" student performance on the test.) Each item should be as difficult or easy as the level of behavior and nature of the objective which it tests.

With the information gathered from completing these four steps, you should now be prepared to develop the actual test items. (Assignments 4.3 and 4.4 provide specific information on the techniques of test item construction.) A first draft of each item should be written on a 5 x 8 card. Placing the items on individual cards will facilitate the subsequent editing and arrangement of these items into the final version of the test. For longer tests with a large number of items it is often useful to key the cards to the specific objective (or cell of the Table) to which the item refers.

Step 5: Assembling the Test

The next task is to assemble the items into a test that can be easily administered, completed and scored. A variety of specific activities should be completed as described below to accomplish this task.

1) Review items for technical defects. Using the ten general Rules for Test Item Construction (see Content Summary for this lesson), review all of your test items for proper style and format. It is often helpful to ask someone else to review your items at this point.

2) Check that the items match the Table of Specifications. Organize the items by cell of the Table to insure that your actual items match your intended sampling plan.

3) Group the items by objective. In criterion-referenced tests, there is no reason to scatter the items on a particular subject throughout the test. Having all the items testing performance on a specific objective together on the test also makes it easier to score and interpret the test's results. At this point simply group all the items on a given objective together in any order.

4) Arrange items from least to most difficult within objectives and across the test as a whole. A criterion-referenced test will work best if the trainee is allowed to answer the easiest questions first before moving on to the harder ones. Later, when scoring the test and interpreting the results, the easy-to-hard organization also enables you to quickly estimate the points at which trainee preparation fails and further instruction is needed. Therefore, first sequence the items by difficulty that are designed to test performance on a given objective. Then, place these groups of sequenced items in order according to the relative overall difficulty of the objective. Your items are now in the final order in which they will appear on the test. (The first item on the test should be the easiest item on the easiest objective.)

5) Number the items consecutively.

6) Develop clear directions for completing the test. Your directions to the person taking the test should be carefully written and appear on the test itself. These directions should explain the purpose of the test and the amount of time and any conditions under which it is to be completed. You should also provide specific instructions for answering each type of item. For tests using multiple choice and true-false items, directions should also be given regarding what to do about guessing. (The best advice is to tell trainees to answer every item - including the use of guesses if they have to.)

7) Arrange and type the test on the page so that it is easy to read, complete and score.

Check List For Evaluating Criterion-Referenced Tests

Review the quality of the test by checking for the presence of the following characteristics of good criterion-referenced tests. Place a check in the space to the left if the test appears to reflect that characteristic. You should use the back of this form to offer comments, explanations, or suggestions regarding any problems or weaknesses you find in the test.

☐ 1. The test is typed clearly and readably with proper amount of space for student responses.

☐ 2. The directions for completing the test are clear and explicit.

☐ 3. The directions explain the purpose of the test.

☐ 4. The directions explain what the student should do about guessing when uncertain of the answer.

☐ 5. The format of the test items (short-answer, multiple-choice, true-false, matching, etc.) appears appropriate to the content of the items.

☐ 6. The items have been designed such that student responses should be easily and objectively scored.

☐ 7. Test items are grouped by subject (or instructional objective).

☐ 8. Test items proceed from easy to difficult.

☐ 9. The difficulty of the test items matches the nature of the competency being tested.

☐ 10. The items are not all directed towards measuring the simplest kinds of cognitive behavior (i.e., knowledge), unless that is appropriate to the competency being tested.

☐ 11. Test items do not "give away" answers.

☐ 12. The length of the test seems appropriate to the nature and importance of the competency being tested.

Step 6: Testing the Test

Before administering the test to trainees, it should always be reviewed by at least one person familiar with the content who has not been immediately involved in creating the test items. This review should at least ensure that the directions and the items are clear and readable (and free of typographical errors). The Checklist for Criterion-Referenced Tests on the following page provides a good means for reviewing your test. If possible, you should actually have someone take the test as a trial of its design. You can then ask the trial test-taker exactly how each item worked and specifically whether the responses to some items were "give-aways", or overly tricky, or easily misinterpreted. Identifying and correcting problems with specific items now can save a lot of confusion and difficulty in the later use of the test.

Step 7: Interpreting the Test

Once the test has finally been given to the intended group of trainees, the final activity is to interpret the test results. This task involves the completion of five separate activities as follows.

1) Score correct and incorrect items.
2) Group results by objective.
3) Calculate number correct and percentage correct.
4) Determine if the desired competency has been achieved. (By comparing test results to the performance standard.)
5) Report the test results to the trainees and use the results to inform subsequent training decisions as appropriate.

Example Preparation of a Criterion-Referenced Test

The following material presents a step-by-step description of the development of a criterion-referenced test. The test under development here is intended to measure the achievement of the objectives for the first lesson of this unit (Unit Four). Therefore, any background material for preparing the test (instructional objectives, content, etc.) comes directly from the Staff Guide and Participant Reference Manual materials for this unit.

Step 1: Deciding What to Test

What areas of trainee competencies should the test be designed to assess? From the Staff Guide, the objective for this lesson was given as instructing participants so that they may be able to:

-Describe the use and characteristics of simple written tests, check lists and rating scales for evaluating trainee performance.

What kind of performance is required? The focus of this lesson is on cognitive behaviors in the design of evaluations. However, the lesson's objective encompasses a variety of specific behaviors at different levels of cognitive performance. To actually construct a Table of Specifications and write the test items it is often necessary to break out these more specific objectives by cognitive level. Thus, the objective for Lesson One, that participants will be able to:

-Describe the use and characteristics of simple written tests, check lists and rating scales for evaluating trainee performance.

can be broken down as follows:

Knowledge level objectives

-Identify the location of evaluation activities within the instructional development process.

-List the uses of written tests.

-List the types of written tests.

-State the uses of check lists and rating scales.

Comprehension level objectives

-Describe the rules for writing test items.

-Describe the rules for constructing check lists and rating scales.

-Explain a typical use of written tests.

-Explain a typical use of a check list.

Application level objectives

-Contrast the use of check lists and rating scales.

-Analyze the limitations of using check lists and rating scales in on-the-job situations.

-Compare the advantages and limitations of short-answer, multiple-choice, essay and true/false items.

-Distinguish between evaluation activities to assess trainee competence and the evaluation of instructional effectiveness.

The objective for lesson two would also be broken down in a similar fashion.

How much should the test cover? The decision was made to design a test to cover Lesson One.

Step 2: Setting Performance Standards

How well should trainees perform on the test? Lesson One is an introductory lesson providing instruction in basic concepts needed for some of the more complicated activities of later lessons. Since the material is simple and fundamental, one could expect a high level of performance. The nature of the behaviors called for on the test are also not expected to be very difficult which also argues for a relatively high performance standard. Therefore, the performance standard is set at 90%.

Step 3: Defining the Sample of the Performance to Be Tested

What is an appropriate sample of the behaviors for which we wish to test? Since the test will only cover the objectives of a single, brief lesson, it seems appropriate to limit the test to ten items. Using the break down of the objective by level of cognitive behavior completed in Step 1, the Table of Specifications can be completed as shown.

Type and Level of Objective Specific Objective	Cognitive-Knowledge	Cognitive-Comprehension	Cognitive-Application	Cognitive-Problem Solving	Affective	Psychomotor	Total Items
1) Describe use and characteristics of simple tests, checklists and rating scales.	3	3	4				10
Total items	3	3	4				10

Step 4: Developing Test Items

Multiple-choice and short-answer item formats were chosen for the test. The actual items as developed appear in the test on the following page.

Criterion-Referenced Test on Lesson One of Unit Four

Directions: The following test is designed to assess your achievement of the objective for Lesson One: Introduction to Evaluation and the Use of Written Tests, Check Lists, and Rating Scales. Complete each of the following items by filling in the best word or phrase that completes the statement or by circling the best alternative from the choices provided. Complete every item even if you are unsure of the correct answer. You have five minutes to complete the test.

1) Written tests are typically useful as a means of evaluating trainee...

   a) Knowledge of facts
   b) Attitudes
   c) Problem solving ability
   d) All of the above
   e) Items (a) and (c)

2) The four kinds of test item formats are ____________________, ____________________, ____________________ and ____________________.

3) Check lists are most useful for evaluating trainee...

   a) Knowledge
   b) Attitudes
   c) Problem solving ability
   d) On-the-job performance
   e) Items (b) and (d)

4) A check list is defined as ____
____

5) A rating scale is defined as ____
____

6) Explain the use of check lists and rating scales ____________________
____
____

7) Ten rules for constructing good test items have been given as follows

Test items

1) Should be clear
2) Should be uncluttered
3) Should be functional
4) Should be at proper level of difficulty
5) Should call on desired behavior
6) Should thoroughly sample that behavior
7) Should provide a positive test of that behavior
8) Should have clearly correct answers
9) Should not "give away" answer
10) Should not "give away" answers to other items

Have any of these rules been violated in preceding six items of this test? If one or more of the rules was/were violated, state which one(s) and list the item(s) involved.

Rule violated	In item(s)

8) Of the four kinds of test item formats, which are considered most useful for criterion-referenced tests?

____

____

9) Explain why some types of items are considered inappropriate for criterion-referenced tests. ____________________

____

10) Which of the following is/are characteristics of norm-referenced tests (as opposed to criterion-referenced tests)?

a) The test enables the comparison of one student to the total group of students.
b) The test compares the performance of individual students against a specified objective that defines the desired quality of performance.
c) This test is most appropriate when the concern is simply with determining the trainee's ability to perform a job.
d) All of the above.
e) None of the above.

Step 5: Assembling the Test

The various steps for assembling the test were completed to construct the test as shown.

Step 6: Testing the Test

If time allows, you may wish to complete the test yourself and check your responses. (The correct answers to the items are given on the bottom of this page.) You should also review the test using the Check List for Evaluating Criterion-Referenced Tests provided earlier in this assignment.

Step 7: Interpreting the Test

If you took the time to complete the test, did you meet the performance standard of 90%? If you failed to achieve this standard does that mean that the standard should be changed, the test revised, or additional instruction provided?

Answers to Criterion-Referenced Test on Lesson 1.

1) e.
2) multiple-choice, short-answer, true-false, essay.
3) d.
4) A list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job.
5) A list of skills or tasks with each so carefully defined as to permit judgments as to the relative quality of the trainee's performance.
6) They are used to evaluate on-the-job performance of a particular task, skill, or procedure.
7) Rule 10 has been violated between items 3 and 6 (possibly including items 4 and 5, as well).
8) Short-answer and multiple-choice).
9) Essay-type items can be time consuming to give and difficult to analyze objectively. True-false items are usually too easy.
10) a.

UNIT FOUR: DESIGNING EVALUATIONS
LESSON 2 of 4: CRITERION-REFERENCED TESTING

ASSIGNMENT 4.2 EXERCISE IN CONSTRUCTING CRITERION-REFERENCED TESTS - Part I

Estimated time: 40 minutes

This assignment is intended to give you practice in the design of criterion-referenced tests. Following directly upon the readings and example provided by Assignment 4.1, you will work with several other participants in the workshop to complete the first three steps of the seven-step procedure for designing and using criterion-referenced tests. By completing the first three steps you will have constructed a Table of Specifications for the test. A later assignment (Assignment 4.5) will give you an opportunity to complete most of the remaining steps of the complete procedure.

OBJECTIVE: By the conclusion of this assignment you will be able to begin designing a criterion-referenced test up through the completion of the Table of Specifications.

EVALUATION: Your test design decisions will be reviewed by other participants in the workshop and the test that you ultimately create (in Assignment 4.5) will be subjected to the Checklist for Evaluating Criterion-Referenced Tests.

DIRECTIONS:

1. At the direction of your instructor, form a team of two or three participants to work on this assignment (and Assignment 4.5).

2. Determine the subject for the criterion-referenced test. Your instructor may suggest that you are to design a test for a course in safe driving habits or some other subject.

3. Complete the first three steps of the procedure for constructing criterion-referenced tests as outlined in Assignment 4.1. In order to complete the first step, you should develop at least four objectives for the course.

4. Refer to any of your materials (such as those on identifying objectives by type and level) as necessary to complete the assignment.

5. You have 40 minutes in which to complete the first three steps and fill out the blank Table of Specifications on the next page.

TABLE OF SPECIFICATIONS

Type and Level of Objective Specific Objective	Cognitive - Knowledge	Cognitive-Comprehension	Cognitive-Application	Cognitive-Problem Solving	Affective	Psychomotor	Total Items
Total Items							

UNIT FOUR: DESIGNING EVALUATIONS
LESSON 3 of 4: TEST ITEM CONSTRUCTION

ASSIGNMENT 4.3 CONSTRUCTING MULTIPLE CHOICE ITEMS

Estimated time: 25 minutes

This assignment is designed to provide you with a review of the basic techniques for constructing the most useful of the selection-type test items for criterion-referenced tests. The introductory reading reviews the characteristics of multiple choice items and the principles for their construction. An accompanying exercise provides practice in constructing this type of item.

OBJECTIVE: By the conclusion of this assignment, you will be able to construct multiple choice items.

EVALUATION: Your performance on the exercise may be reviewed in class at the end of this assignment.

DIRECTIONS: 1. Complete the reading entitled "Introduction to Multiple Choice Items". This should take approximately 10 minutes.

2. Complete one or the other of the two versions of "Exercise in Constructing Multiple Choice Items". One version of the exercise has been designed for those familiar with wastewater treatment facility operators. The other version of the assignment has been designed for drinking water specialists. Either version of the exercise should require about 15 minutes to complete.

3. Be prepared to participate in a brief discussion or review of your responses to the exercise.

Introduction to Multiple Choice Items

While there are many kinds of test items (true/false, short-answer, matching, completion), the multiple choice item is considered the most versatile type of item. It can be used to test a wide variety of behaviors and provides an objective, easily-scored testing format.

The multiple-choice item consists of two major parts: (1) the stem (also called lead, premise, problem, question); and (2) the alternatives (answers, distractors, foils or decoys).

The basic usefulness of the multiple-choice test is that it can answer questions relating to:

1. Definition

   Example item: What means the same as ____________?

2. Purpose

   Example item: What is the reason for ____________?

3. Cause

   Example item: Under which conditions is this true?

4. Effect

   Example item: If this is done, what will happen?

5. Association

   Example item: What occurs in connection with __________?

6. Identification of error

   Example item: What principle is violated?

7. Difference

   Example item: What is the difference between __________?

8. Arrangement

   Example item: Which is the first step in _________?

9. Common principle

   Example item: Which one of the following is not related to _______________?

10. Controversial subjects

    Example item: The x pump is better because _________?

The multiple-choice test item has various advantages and limitations when compared with other teacher-made tests.

Advantages:

1. It can be constructed to measure mental abilities from simple recognition to some aspects of critical thinking (dependent upon skill of test construction).

2. It presents less possibility of guessing the correct answer than other selection-type items.

3. It has less vagueness and ambiguity than short-answer or supply-type items.

4. It is practically free from response sets; therefore, students do not have the opportunity to favor a particular alternative when they don't know the answers.

5. It is useful as a diagnostic technique.

Limitations:

1. It is only a substitute for more direct means of measurement; only an indicator of the ability of the student to perform in an actual situation.

2. It is not designed to measure all types of behavior. (Multiple choice items are sometimes inappropriate for measuring problem-solving behaviors.)

3. It is difficult to construct. The test-maker must be skilled in writing items that will measure the student's ability to interpret, discriminate, select and evaluate rather than the ability to memorize.

The following principles of test construction, if followed by the test-maker, will ensure fair, good test items:

1. Write test items which will measure specific, significant learning outcomes.
2. Use either a direct question or an incomplete statement as the item stem, whichever seems more appropriate to the presentation of the item.
3. Write items in clear and simple language, with vocabulary kept as simple as possible and at the level appropriate for the students.
4. Base each item on a single, central problem.
5. State the central problem of the item clearly and completely in the stem.
6. In general, include in the stem any words that must otherwise be repeated in each response.
7. Avoid negative statements.
8. Avoid excessive use of non-relevant material.
9. Place the choices at the end of the incomplete statement.
10. Make the responses grammatically consistent with the stem and parallel with one another.

11. Make all responses plausible and attractive to people who lack the information and ability tested by the item.

12. Make the responses independent and mutually exclusive.

13. Use the "none-of-these" option with caution.

14. Write distractors (incorrect alternatives) which do not contain clues revealing the correct answer.

15. Decide before writing if the correct or best answer is required, then be sure that there is only one correct answer if that is what is required or that all the answers have some elements of correctness with one best answer (based upon evidence).

16. Compose clear and definite directions for "taking" the test.

Exercise in Constructing Multiple Choice Items
(For Wastewater Treatment Facility Operators)

Directions: Complete the following activities which are designed to provide you with practice in constructing multiple choice items. You have 15 minutes to complete this exercise.

I. Write appropriate stems for each of the following sets of alternatives.

A. (stem:)

1. The oxygen required to sustain aerobic biological oxidation in sewage or waste.
2. The amount of dissolved oxygen required to support life in a stream.
3. The required oxygen level to oxidize toxic metals.
4. The concentration of oxygen required to ensure aerobic biological oxidation of sewage or waste.

B. (stem:)

1. pH of 1
2. pH of 5
3. pH of 7
4. pH of 9
5. pH of 14

II. Write three or more alternatives for each of the following stems.

A. A Parshall Flume is used to

1.

2.

3.

B. When computing gas production for the anaerobic digestion system, what is the rate of volatile solids destroyed per cubic foot of gas?

1.

2.

3.

C. What causes the change in pH values in the anaerobic digestion system?

1.

2.

3.

III. Write two multiple choice test items on a subject familiar to you.

A.

1.

2.

3.

B.

1.

2.

3.

Exercise in Constructing Multiple Choice Items
(For Drinking Water Specialists)

Directions: Complete the following activities which are designed to provide you with practice in constructing multiple choice items. You have 15 minutes to complete this exercise.

I. Write appropriate stems for each of the following sets of alternatives.

A. (stem:)

1. Distilling over the interferences and leaving the F^- behind.
2. Distilling over the F^- and leaving the interferences behind.
3. Forming a color with the interferences.

B. (stem:)

1. Became effective in December of 1977.
2. Became effective in December of 1975.
3. Became effective in June of 1977.

II. Write three or more alternatives for each of the following stems.

A. Nitrate can be determined by

1.

2.

3.

B. Samples containing metals are preserved by adding

1.

2.

3.

C. The reason for the MCL on turbidity is because

1.

2.

3.

III. Write two multiple choice test items on a subject familiar to you.

A.

1.

2.

3.

B.

1.

2.

3.

UNIT FOUR: DESIGNING EVALUATIONS
LESSON 3 of 4: TEST ITEM CONSTRUCTION

ASSIGNMENT 4.4 CONSTRUCTING SHORT ANSWER ITEMS

Estimated time: 20 minutes

This assignment is designed to provide you with a review of the basic techniques for constructing the most useful of the supply-type test items for criterion-referenced tests. The introductory reading reviews the characteristics of short answer items and principles for their construction. An accompanying exercise provides practice in constructing these items.

OBJECTIVE: By the conclusion of this assignment, you will be able to construct short answer items.

EVALUATION: Your performance on the exercise may be reviewed in class at the end of this assignment.

DIRECTIONS: 1. Complete the reading entitled "Introduction to Short Answer Items". This should take no more than 5 minutes to complete.

2. Complete the "Exercise in Constructing Multiple Choice Items". This should require about 15 minutes to complete.

3. Be prepared to participate in a brief discussion or review of your responses to the exercise.

Introduction to Short Answer Items

The short answer test item asks the student to recall information in his own words. It is important to remember, however, that the judgment of acceptable answers should not be influenced by the student's writing skill. Items should be designed so that the acceptable answer can be as brief as possible; a word, phrase, symbol, number, etc. In some cases, the student may have to write a sentence or two as a response.

Compared to multiple choice items, short answer items are easy for the instructor to write, but rather more difficult to "correct". They are suitable for testing a wide range of learning outcomes. Some examples of short answer items are listed below.

1. What is the pH of pure water? 1. ________________

2. If acid is present, litmus paper turns 2. ______________

3. In the equation $5x + 5 = 15$, what is the value of x? 3. ______________

4. State two tests for the presence of acid. 4. ______________

Suggestions for writing and correcting short-answer items:

1. Avoid the loose, ambiguous item that does not tie down the answer to one or two specific words or phrases.

2. Do not require more than one or two completions to be made in any one item.

3. For "filling the blank" type items, place the blank near the end of the statement.

4. Avoid cues to the correct answer.

5. In computation problems, specify the degree of accuracy expected.

6. Make the directions and each question explicit.

7. Allow sufficient space for student answers in a column to the right of the questions.

8. Write a scoring key in advance and include all possible acceptable answers for each item.

9. Use a variety of short answer formats. Avoid extensive use of "fill in the blanks" as these often do not test for higher-order learning outcomes.

Exercise in Constructing Short-Answer Items

Directions: Complete the following activities which are designed to provide you with practice in constructing short-answer items. You have 15 minutes to complete this exercise.

I. Convert the following items from multiple choice to short-answer formats. Write your new item in the space provided.

A. If the temperature is allowed to go beyond 180° C

1. the fluoride is not distilled.
2. the iron carries over.
3. sulfate is carried over.

A. (Short-answer version)

B. Which of the following steps must be performed in order to express the value of "total" barium?

1. filtration
2. weighing
3. solubilization or digestion

B. (Short-answer version)

II. Write five short-answer items in the space below. No more than four of these items should be simple "fill-in-the-blank" items. After each item, list all possible correct answers (for use in correcting responses to the items). Base the items on a subject familiar to you or use material from a subject in this workshop (such as the material on writing objectives).

1.

Possible correct answers:

2.

Possible correct answers:

3.

Possible correct answers:

4.

Possible correct answers:

5.

Possible correct answers:

UNIT FOUR: DESIGNING EVALUATIONS
LESSON 3 of 4: TEST ITEM CONSTRUCTION

ASSIGNMENT 4.5 EXERCISE IN CONSTRUCTING CRITERION-REFERENCED TESTS - PART II

Estimated time: 30 minutes (to complete Steps 4 and 5 of the procedure -- an additional 30 minutes may be used for the review and critique which follows

This assignment is the second part of the practice exercise in constructing criterion-referenced tests begun in Assignment 4.2. Working from the Table of Specifications developed in that earlier assignment, you will complete Steps 4 and 5 of the procedure for constructing criterion-referenced tests (as originally explained in Assignment 4.1). To complete this assignment, you will be working in the same teams as before. When your team completes Step 5, submit your finished criterion-referenced test to the instructor or another team for the kind of review which constitutes Step 6 of the procedure.

OBJECTIVE: By the conclusion of this assignment you will be able to complete the design of a criterion-referenced test.

EVALUATION: Your completed criterion-referenced test will be reviewed by the instructor or other participants according to Step 6 of the procedure outlined in Assignment 4.1.

DIRECTIONS:

1. Reform the team of two or three participants who worked with you on Assignment 4.2.
2. Complete the design of your criterion-referenced test following the directions of Steps 4 and 5 (Assignment 4.1) and the Table of Specifications you developed in Assignment 4.2. You have 30 minutes to complete these steps.
3. Submit your completed test and Table of Specifications for review to another team of participants, or the instructor.
4. Conduct a review of another team's completed test following Step 6 of Assignment 4.1. You have 30 minutes to complete this part of the assignment.

COURSE EVALUATION QUESTIONNAIRE

Lecture Courses

Following are several sets of statements concerning specific aspects of this course. Please indicate the extent to which you agree or disagree with each statement by choosing one of the five alternative responses:

1 = strongly agree
2 = agree
3 = disagree
4 = strongly disagree
5 = uncertain or not applicable

I. Instructor-Student Rapport

____ (1) The instructor showed fair and equal concern for all students.

____ (2) The instructor expected high standards of performance from himself as well as the students.

____ (3) The instructor answered questions in a straightforward and understandable manner.

____ (4) The instructor encouraged individual help and discussion.

____ (5) The instructor was prompt in meeting class and in keeping appointments.

____ (6) Students were given an opportunity to ask questions about the lecture material.

II. Subject Matter and Presentation of Material

____ (7) The content of this course was valuable to me.

____ (8) The instructor seemed to be genuinely enthusiastic about the course and subject matter.

____ (9) Students discussed the lecture material outside of class.

____ (10) Lectures were well organized.

____ (11) It was obvious that the instructor had prepared for his lectures.

____ (12) The instructor presented material that was too advanced for the level of the course.

____ (13) The instructor's delivery was dull.

____ (14) The instructor frequently digressed from his lecture topic and dwelt on the irrelevant.

____ (15) It was easy to follow the lecture.

____ (16) Lectures were presented in such a way that it was easy to take notes.

____ (17) The lectures merely summarized the textbook(s).

____ (18) The lecturer's voice was monotonous.

____ (19) The instructor exhibited annoying mannerisms.

____ (20) The lectures proved helpful when it came time for evaluation and grading.

____ (21) The lectures were inclined to show the instructor's bias and did not provide various points of view.

____ (22) The pace of the lectures was too rapid.

III. Tests and Grading

____ (23) The tests were fair and objective.

____ (24) The instructor provided an opportunity for the students to discuss the tests at a later time.

____ (25) The tests were effectively integrated with the course content.

____ (26) The expectations concerning performance standards for students were clearly specified at the start of the course.

Any additional comments you would like to make about the course, or clarifications of your ratings above:

IV. Reactions to this Evaluation

Did this questionnaire provide a useful way for you to describe your experiences and thoughts regarding this course? How could this questionnaire be improved?

V. Recommendations for Change

Each of the statements listed below represents frequently-stated recommendations from students concerning how they would like to see their courses changed. Pick three recommendations for change that you think are most important for this course. Rank the three recommendations in order of importance where 1 = the most needed change, and rankings of 2 or 3 are needed changes of relatively lesser importance.

____ (27) The work load should be lighter.

____ (28) The work load should be heavier.

____ (29) The course goals and objectives should be stated more clearly.

____ (30) The course goals and objectives should be followed more consistently.

____ (31) The examinations should more clearly reflect the course goals.

____ (32) The examinations should demand less memorization and more thought.

____ (33) The course should be more tightly structured.

____ (34) The course should be more loosely structured.

____ (35) The assignments should be clearer.

____ (36) The instructor should exhibit more openness to critical questions from students.

____ (37) The instructor should be more responsive to the dissatisfaction of students concerning the way the course is being taught.

____ (38) The instructor should update the material he is presenting in the course.

____ (39) The instructor should use new teaching methods.

____ (40) The instructor should do more lecturing.

____ (41) The instructor should be more concerned with students who do not speak up in class.

____ (42) The instructor should ramble around less when lecturing.

____ (43) The instructor should speak more slowly when lecturing.

____ (44) The physical setting (classroom, studio, etc.) for this course should be changed.

____ (45) The instructor should more clearly relate the content of this course to problems and issues that are of immediate concern to the students.

____ (46) The instructor should plan for more discussion in this course.

____ (47) The instructor should do less lecturing.

____ (48) The instructor should use a more equitable and less subjective method of grading.

____ (49) The instructor should allow fewer students into this course.

____ (50) The instructor should find a new textbook for this course.

COURSE EVALUATION QUESTIONNAIRE

Laboratory Courses

Following are several sets of statements concerning specific aspects of this course. Please indicate the extent to which you agree or disagree with each statement by choosing one of the five alternative responses:

1 = strongly agree
3 = disagree
5 = uncertain or nonapplicable
2 = agree
4 = strongly disagree

I. Structure and Goals

____ (1) The instructor clearly specified the objectives of the laboratory.

____ (2) My own learning objectives for this laboratory have been achieved.

____ (3) The content of the laboratory sessions has been highly relevant to the objectives of the course as a whole.

____ (4) The number of students in this laboratory section has been appropriate for learning to occur.

____ (5) The instructor clearly stated the objectives of each laboratory exercise.

____ (6) The instructor was open to the ideas, suggestions, and criticisms of the students.

II. Subject Matter and Instruction

____ (7) The instructor distributed directions and procedures for laboratories sufficiently in advance of the lab sessions.

____ (8) The instructions for completing each lab session were clear.

____ (9) The instructor provided sufficient opportunity for questions to be asked and for laboratory assistance.

____ (10) The instructor demonstrated fundamental techniques in such a way that I could use them.

____ (11) Special preparations, materials, or equipment were available on time.

____ (12) The equipment was adequate and reliable.

____ (13) Students were encouraged to conduct their own laboratory experiences.

____ (14) There was sufficient opportunity to do creative and imaginative work in the laboratory.

____ (15) I learned a great deal from the other students in the laboratory.

____ (16) This laboratory was essential to my understanding of other segments of this course.

III. Expectations and Evaluation

____ (17) I was given sufficient opportunity to demonstrate my knowledge and skills in conducting laboratory work.

____ (18) The criteria for assessing my performance in this laboratory section were clearly stated and consistently employed.

____ (19) The instructor did not expect me to spend more time in this course than I had originally anticipated.

____ (20) I clearly understood before entering the course how much materials would cost.

Any additional comments you would like to make about the course:

IV. Reactions to this Evaluation

Did this questionnaire provide a useful way for you to express your experience and thoughts on this course? How could it be improved?

V. Recommendations for Change

Each of the statements listed below represents frequently-stated recommendations from students concerning how they would like to see their courses changed. Pick three recommendations for change that you think are most important for this course. Rank the three recommendations in order of importance where 1 = the most needed change, and rankings of 2 or 3 are needed changes of relatively lesser importance.

____ (21) The work load should be lighter.

____ (22) The work load should be heavier.

____ (23) The course goals and objectives should be stated more clearly.

____ (24) The course goals and objectives should be followed more consistently.

____ (25) The examinations should more clearly reflect the course goals.

____ (26) The examinations should demand less memorization and more thought.

____ (27) The course should be more tightly structured.

____ (28) The course should be more loosely structured.

____ (29) The assignments should be clearer.

____ (30) The instructor should exhibit more openness to critical questions from students.

____ (31) The instructor should be more responsive to the dissatisfaction of students concerning the way the course is being taught.

____ (32) The instructor should update the material he is presenting in the course.

____ (33) The instructor should use new teaching methods.

____ (34) The instructor should do more lecturing.

____ (35) The instructor should be more concerned with students who do not speak up in class.

____ (36) The instructor should ramble around less when lecturing.

____ (37) The instructor should speak more slowly when lecturing.

____ (38) The physical setting (classroom, studio, etc.) for this course should be changed.

____ (39) The instructor should more clearly relate the content of this course to problems and issues that are of immediate concern to the students.

____ (40) The instructor should plan for more discussion in this course.

____ (41) The instructor should do less lecturing.

____ (42) The instructor should use a more equitable and less subjective method of grading.

____ (43) The instructor should allow fewer students into this course.

____ (45) The instructor should find a new textbook for this course.

COURSE EVALUATION QUESTIONNAIRE

Seminar and Discussion Courses

Following are several sets of statements concerning specific aspects of this course. Please indicate the extent to which you agree or disagree with each statement by choosing one of five alternative responses:

1 = strongly agree
2 = agree
3 = disagree
4 = strongly disagree
5 = uncertain or not applicable

I. Structure and Goals

____ (1) The size of this class was appropriate for effective student participation.

____ (2) The instructor was open to ideas, suggestions, and criticisms of the students.

____ (3) The subject matter introduced in the course clearly and consistently reflected the course goals.

____ (4) The learning objectives of the course were clarified by the instructor at the beginning of the course.

____ (5) The learning objectives of the course were at least in part determined by the students.

____ (6) My own learning objectives were achieved by the end of the course.

II. Subject Matter and Instruction

____ (7) The instructor encouraged and helped interaction among the students.

____ (8) The instructor presented and encouraged multiple viewpoints on controversial subjects.

____ (9) The group frequently was side-tracked in its discussions.

____ (10) The instructor was helpful to the group when it floundered during discussions.

____ (11) The other students restricted my contribution to the discussion.

____ (12) The instructor restricted my contribution to the discussion.

____ (13) I learned a great deal from the other students.

____ (14) I made significant contributions to the discussions in this course.

____ (15) I benefited more from this seminar than I would have if it were a lecture-based course.

____ (16) The instructor actually lectured rather than led discussions.

III. Expectations and Responsibilities

____ (17) The course requirements were clearly defined.

____ (18) I received fair recoginition for the amount of work I performed.

____ (19) The instructor stimulated and encouraged self-initiative.

____ (20) Prior to entering the course, I was fully aware of seminar or small group discussion procedures.

____ (21) More responsibility was expected of the students for their own learning in this course than in a lecture course.

____ (22) Students were actively involved in planning for this course.

Any additional comments you would like to make about the course, or clarifications of your ratings above:

IV. Reactions to this Evaluation

Did this questionnaire provide a useful way for you to describe your experiences and thoughts regarding this course? How could this questionnaire be improved?

V. Recommendations for Change

Each of the statements listed below represents frequently-stated recommendations from students concerning how they would like to see their courses changed. Pick three recommendations for change that you think are most important for this course. Rank the three recommendations in order of importance where 1 = the most needed change, and rankings of 2 or 3 are needed changes of relatively lesser importance.

____ (23) The work load should be lighter.

____ (24) The work load should be heavier.

____ (25) The course goals and objectives should be stated more clearly.

____ (26) The course goals and objectives should be followed more consistently.

____ (27) The examinations should more clearly reflect the course goals.

____ (28) The examinations should demand less memorization and more thought.

____ (29) The course should be more tightly structured.

____ (30) The course should be more loosely structured.

____ (31) The assignments should be clearer.

____ (32) The instructor should exhibit more openness to critical questions from students.

____ (33) The instructor should be more responsive to the dissatisfaction of students concerning the way the course is being taught.

____ (34) The instructor should update the material he is presenting in the course.

____ (35) The instructor should use new teaching methods.

____ (36) The instructor should do more lecturing.

____ (37) The instructor should be more concerned with students who do not speak up in class.

____ (38) The instructor should ramble around less when lecturing.

____ (39) The instructor should speak more slowly when lecturing.

____ (40) The physical setting (classroom, studio, etc.) for this course should be changed.

____ (41) The instructor should more clearly relate the content of this course to problems and issues that are of immediate concern to the students.

____ (42) The instructor should plan for more discussion in this course.

____ (43) The instructor should do less lecturing.

____ (44) The instructor should use a more equitable and less subjective method of grading.

____ (45) The instructor should allow fewer students into this course.

____ (46) The instructor should find a new textbook for this course.

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT FIVE
SELECTING INSTRUCTIONAL METHODS

Estimated time for unit: Two hours

The CONTENT of this unit:

This unit provides a trainer with some assistance in deciding what methods should be used to deliver instruction for specific types and levels of behavior. The unit consists of a review of the four types of instructional methods in a reading and in group discussion. A second assignment provides practice in selecting methods for specific types and levels of behavior. A discussion of participants' choices concludes the unit.

The OBJECTIVES of this unit:

By the end of this unit, you will be able to:

-list and describe the four types of instructional methods
-give at least two advantages and disadvantages of each
-use the Instructional Methods Selection Table to select instructional methods for specific types and levels of behavior.

The PURPOSE of this unit:

Instructional methods each have their own particular strengths and weaknesses. When designing instruction, it is helpful to have some guidance in choosing the most appropriate method for delivering it. This unit provides some help in this area so that methods are not arbitrarily chosen.

The RESOURCES for this unit:

1. Assignment 5.1 Four Types of Instructional Methods
2. Assignment 5.2 Exercise in Selecting Instructional Methods
3. Instructional Methods Selection Table

UNIT FIVE: SELECTING INSTRUCTIONAL METHODS
LESSON 1 of 2: FOUR TYPES OF INSTRUCTIONAL METHODS

ASSIGNMENT 5.1: FOUR TYPES OF INSTRUCTIONAL METHODS

Estimated time: Twenty minutes

> The following is an extended outline of the definition, characteristics, advantages and disadvantages of each of the four methods. Read through the outline and note any items you might have questions about for the discussion which follows.

I. Four Types of Methods

   A. Lecture

   B. Demonstration

   C. Guided Discussion

   D. Adaptive Instruction

      1. Individualized learning packages

      2. Assignments

      3. Tutorials

II. Why Four Methods?

   The four methods represent the four possible types of communication between instructors and learners

   A. Lecture - communication of verbal information from instructor to learners

   B. Demonstration - communication of verbal information and visual display of skills from instructor to learner

   C. Guided Discussion - sharing of communication among instructor and learners

   D. Adaptive Instruction - individual reception of communication from printed materials or from tutor

III. The Lecture (Method #1)

   A. Definition - uninterrupted speech by which one presents information to others

B. Characteristics of a Good Lecture

1. The lecturer has good public speaking skills

2. The presentation is

   a. brief - usually no more than 15-20 minutes of uninterrupted speech; a lecture should not strain normal attention span

   b. organized

      i) the introduction
         (a) establishes rapport between lecturer and learners
         (b) defines the purpose of the lecture, gains learners' attention, and motivates them to remain attentive
         (c) outlines the major points of the lecture
         (d) defines the objectives of the lecture

      ii) the body
         (a) uses a simple-to-complex structure for presenting the content
         (b) aims toward specific objectives
         (c) provides opportunities for questioning
         (d) allows for practice of knowledge

      iii) the conclusion
         (a) reviews and summarizes main points
         (b) opens opportunity for student responses
         (c) provides directions to the next activity

   c. accompanied by media (when appropriate)

      i) highlighting - visual accompaniments such as outlines, graphics, pictures - reinforce content during the lecture

      ii) student handouts - "take-homes" such as outlines, procedural guidelines, etc. - serve as a personal employee manual for on-the-job use

C. Advantages

1. Presents large amounts of information from many or from hard-to-get sources in short amount of time

2. Gives instructor control over the kind of information and organization presented

3. Provides the most efficient way to introduce and to summarize a learning experience

D. Disadvantages

  1. Over stresses acquisition of facts
  2. Can make learners into passive, dependent receivers of information
  3. Is instructor-paced
  4. Is often too long
  5. Is often over-used or misused
  6. Is not for teaching "how to" (procedures)
  7. Depends for success on instructor's public-speaking ability

IV. Demonstration (Method #2)

A. Definition - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment

B. Characteristics of a Good Demonstration

  1. The instructor prepares site and materials
     a. on-location or simulated site is chosen and prepared for maximum effectiveness and visibility to all learners
     b. materials and equipment obtained and tested by working through demonstration
     c. setup allows everyone to see demonstration
     d. media/handouts prepared to complement demonstration - i.e., steps outlined, decision points and criteria defined, "success" described in terms of predefined criteria
  2. The instructor prepares for the students
     a. necessary orientation information developed
     b. mini-lectures for introducing and summarizing the procedure prepared
     c. frequent opportunities provided to ask questions
     d. frequent checks to ensure student understanding
     e. opportunities to practice the procedure

C. Advantages

1. Gives on-the-job experience

2. Allows learners to develop and practice skills under supervision

D. Disadvantages

1. Not useful alone; must be prepared for and summarized through lecture or reading

2. Large groups of learners require much time for practice in order to be effective

3. Useful only for fixed-step procedures, not for creative problem solving

4. Requires equipment, materials, often site visits

V. Guided Discussion (Method #3)

A. Definition - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem

B. Characteristics of a Good Discussion

1. Not a bull session - topics and objectives must be carefully prepared and purpose explicitly defined so that group will know when discussion should end

2. Groups should be small enough to allow everyone to participate and large enough to avoid polarization or domination by a few

3. Discussion leader

a. initiates discussion by stating topics, objectives, guidelines (rules for participating, parameters of discussion)

b. coordinates discussion by summarizing ideas and establishing relationships among ideas

c. orients discussion by pulling discussion back to topic; avoids playing expert and giving lectures

d. encourages participation by warmth, non-critical analysis of contributions, questioning silent members in non-threatening way

e. harmonizes the group by dealing with personal confrontations and disagreements and arbitrating as necessary

f. gate-keeps by preventing anyone from dominating the group

4. Participants

a. participate - purpose is to share ideas in order to develop solution to problem

b. remain non-critical and objective - avoid personal attacks and emotional analyses like "that's stupid"

c. stick to the topic

d. avoid private discussions and share ideas with whole group

e. direct comments and questions to group rather than to leader

f. accept leader as arbitrator of group

5. Physical environment is arranged to facilitate discussion by ensuring eye contact among all participants

C. Advantages

1. Allows all members of group opportunity to share ideas

2. Provides for mutual solving of a problem and practice in ways of solving problems

D. Disadvantages

1. Can be dominated by an individual or faction

2. Can degenerate into an exchange of abuse

3. Can bog down in extended, uncomfortable silence or irrelevancies

4. Can be a front for leader-provided lectures

5. Can be misused (not suitable for communicating factual information or teaching procedures)

VI. Adaptive Instruction (Method #4)

A. Definition - to adapt instruction to individual needs, goals, learning materials and/or instructional methods and techniques especially chosen to suit a particular student or group of students

Types of Adaptive Instruction - individualized learning packages, assignments, tutorials

B. Characteristics of Good Adaptive Instruction

1. Characteristics of effective individualized learning packages

    a. provides all the information and materials learner needs to know on his/her own

    b. provides for practice and feedback

    c. is structured properly (orienting overview, body with logical learning steps, summarizing review)

    d. meets individual needs of learners

2. Characteristics of effective assignments

    a. application oriented - allows students to apply knowledge and skills in new or unfamiliar contexts

    b. allows for choice - provides options so that the students can choose among alternative assignments, contexts, or subjects

    c. builds skills in specific steps from simplest to most complex

    d. provides feedback reinforcement

3. Characteristics of effective tutorials

    a. is a one-to-one session between tutor and learner (tutor need not be the instructor)

    b. has problem-solving orientation using stages of diagnosis and remedy

    c. builds skills in specific steps

    d. tutor guides learner to discover answers - does not lecture at learner

    e. session is problem-specific and ends when solution is discovered

C. Advantages

1. Responsive to individual needs
2. Allows for learner pacing and repetition as desired
3. Individualized learning packages can be given out when it is difficult to organize a class or too few students or no instructor available
4. Tutorials can be used to help several learners with difficult problems in a short space of time

D. Disadvantages

1. Instructor-made individualized learning packages are expensive to prepare
2. Not suitable for complex or complicated subject matter
3. Not useful for teaching procedures that require equipment or complicated materials
4. Does not allow for exchange of ideas and opinions - basically a lonely method of learning

UNIT FIVE: SELECTING INSTRUCTIONAL METHODS
LESSON 2 of 2: SELECTING METHODS FOR SPECIFIC BEHAVIOR

ASSIGNMENT 5.2: EXERCISE IN SELECTING INSTRUCTIONAL METHODS

Estimated time: Sixty minutes

DIRECTIONS:

This assignment provides practice in selecting methods for instruction. The technique used to select methods requires the behavior expected of the learner to be classified as either Cognitive-knowledge, Cognitive-comprehension, Cognitive-application, Cognitive-problem solving, Psychomotor, or Affective.

On the following page is a list of "educational needs" which have not been classified.

For each need:

1. Determine the type of behavior called for. For information on how to classify behavior, review Assignment 3.2 in Unit Three.
2. Read the row of the Instructional Methods Selection Table which corresponds to the behavior category to find out which of the four methods may be useful. For some behaviors more than one method may be appropriate.
3. Choose the instructional method or methods you would use to satisfy each need.

Be prepared to defend your choices in a group discussion.

Suppose each of the following items describes an educational need of students in your class. What Method of Instruction would you use to help these students reach desired learning outcomes? Use the Instructional Methods Selection Table as an aid in completing this exercise.

1. My students must be able to check automatic flow recording equipment for correct operation.

   Type of behavior:______________________________

   Choice of Instructional Method___________________________

2. My students must be able to list fifteen conversion factors commonly used in day-to-day treatment operations.

   Type of behavior:____

   Choice of Instructional Method____

3. My students must be courteous to other employees.

   Type of behavior:____

   Choice of Instructional Method____

4. My students must be able to describe the internal construction of a large piece of plant equipment.

   Type of behavior:____

   Choice of Instructional Method____

5. My students must know how to determine settleable solids, ml/liter.

   Type of behavior:____

   Choice of Instructional Method____

INSTRUCTIONAL METHODS SELECTION TABLE

Instructional Method Types of Behavior	LECTURE	DEMONSTRATION	GUIDED DISCUSSION	ADAPTIVE INSTRUCTION *
COGNITIVE, Knowledge	Appropriate for teaching facts	Generally not useful	Generally not useful	Useful and appropriate for conveying factual information
COGNITIVE, Comprehension	Appropriate	Useful as a supportive method to reinforce concept-using	Generally not useful	Appropriate
COGNITIVE, Application	Appropriate for initial presentation of rules	Most appropriate method for teaching rule-using	Generally not useful	Appropriate for initial presentation of rules
COGNITIVE, Problem-Solving	Generally not useful	Useful for problem-solving instruction	Useful and appropriate for developing problem-solving skills	Exercises are useful for teaching problem-solving
PSYCHOMOTOR	Useful only in support of a demonstration	Live or simulated demonstrations are the most effective method for teaching motor skills	Generally not useful	Useful only in support of a demonstration
AFFECTIVE	Usually not effective for motivating trainees or changing attitudes about something	Modelling and simulations are useful for forming attitudes	Group activities such as role-playing are often useful for attitude formation	Generally not useful

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*Individualized Learning Packages; Assignments; Tutorials

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT SIX
SELECTING MEDIA FOR INSTRUCTION

Estimated time for unit: Two hours

The CONTENT of this unit:

This unit provides trainers with some guidelines for choosing media when designing instruction. A lecture covers the kinds of media which may be useful in training and how this media may be classified. A Media Selection Table is provided and an assignment allows for practice in using it.

The OBJECTIVES of this unit:

By the end of this unit you will be able to:

-list the five categories of media with examples of each
-use the Media Selection Table to choose media for specific instructional content.

The PURPOSE of this unit:

There are many media available for use in instruction. The purpose of this unit is to provide a method for considering the various available media when designing training. The intent of this unit is to guide a trainer through a media selection process which culminates in a trainer decision.

The RESOURCES for this unit:

1. Content Summary
2. Assignment 6.1 Selecting Educational Media for Instruction
3. Media Selection Table

UNIT SIX: SELECTING MEDIA FOR INSTRUCTION
CONTENT SUMMARY

Categories and Examples of Media

1. Objects

   a) real things - provide an opportunity to see, feel, manipulate and use the actual objects connected with the specified objective
   b) people - useful objects for instruction, especially in the psychomotor area
   c) models - may be appropriate when real things are not readily accessible or are too big, small, complex or expensive

2. Still Pictures

   a) flat pictures - especially useful for individual study
   b) slides - may be used to project a high-quality picture for group use; also, individuals using a hand viewer
   c) filmstrips - present a series of pictures in a fixed sequence
   d) overhead transparencies - can project written material, artwork or a photograph with black lines or in color; can be "created" during the instruction
   e) chalkboard - flexible and inexpensive way to present written material and simple illustrations
   f) charts and posters - for simple instruction, reminders, or to gain attention. Flip charts may be especially useful for on-the-job training.

3. Moving Pictures

   a) commercially-produced 16mm films - a highly attractive and attention-compelling medium, may be used to show motion, illustrate actual events and dramatically re-enact stories and events
   b) single concept 8mm loop films - provide demonstrations of single skills, processes, events or ideas; are usually silent
   c) locally produced films - offer many of the advantages of the films described above with the additional capability of presenting instruction tailored directly to instructional needs
   d) instructional television - commercial broadcasts and professionally-produced tapes are similar to commercially-produced films; they can present more current events as well; videotape units can be used to record events or psychomotor behaviors and replay them immediately for instructional feedback.

4. Audio Media

   a) people - instructors and students present information, hold discussions and provide feedback through the common act of speaking
   b) professionally-produced audio materials - present professional musicians, poets, historians and other national or international figures for individual or group use

c) locally-produced audio materials - can present special instructions, guest presentations and student presentations; are flexible and inexpensive to use

5. Written Materials

a) text and reference books - present detailed information which is easily accessible and can be studied at an individual's own pace
b) workbooks - allow for practice of procedures and other learning events where learners can respond in writing to presented problems and often receive direct feedback immediately
c) periodicals - are especially useful for presenting current information
d) teacher-produced handouts - useful for supplying specific instructions on instructional activities and supplemented information; are also used to evaluate learning

UNIT SIX: SELECTING MEDIA FOR INSTRUCTION
LESSON 2 of 2: SELECTING EDUCATIONAL MEDIA FOR INSTRUCTION

ASSIGNMENT 6.1 SELECTING EDUCATIONAL MEDIA FOR INSTRUCTION

Estimated time: Thirty minutes

DIRECTIONS:

This assignment provides practice in selecting media for instruction. The technique used to select media requires the behavior expected of the learner to be classified as either Cognitive-knowledge, Cognitive-comprehension, Cognitive-application, Cognitive-problem solving, Psychomotor, or Affective.

On the following page is a list of "educational needs" which have not been classified.

For each need:

1. Determine the type of behavior called for. For information on how to classify behavior, review Assignment 3.2 in Unit Three. (If you have completed Assignment 5.2 in Unit Five you have already completed this task.)
2. Read the row of the Media Selection Table which corresponds to the behavior category to find out which of the five categorial media may be useful. For some behaviors more than one medium may be appropriate.
3. Choose one preferred and at least one alternate kind of media appropriate for the type of behavior involved.

Be prepared to defend your choices in a group discussion.

Suppose each of the following items describes educational needs of students in your class. What Instructional Media would you use to help these students reach desired learning outcomes? Use the Media Selection Table as an aid in completing this exercise.

1. My students must be able to check automatic flow recording equipment for correct operation.

   Type of behavior ____________________________________
   Preferred medium ____________________________________
   Alternate media _____________________________________

2. My students must be able to list fifteen conversion factors commonly used in day-to-day treatment operations.

   Type of behavior ____________________________________

   Preferred medium ____________________________________

   Alternative media ___________________________________

3. My students must be courteous to other employees.

   Type of behavior ____________________________________

   Preferred medium ____________________________________

   Alternative media ___________________________________

4. My students must be able to describe the internal construction of a large piece of plant equipment.

   Type of behavior ____________________________________

   Preferred medium ____________________________________

   Alternative media ___________________________________

5. My students must know how to determine settleable solids, ml/liter.

   Type of behavior ____________________________________

   Preferred medium ____________________________________

   Alternative media ___________________________________

MEDIA SELECTION TABLE

Categories of Media

Types of Behavior	OBJECTS	STILL PICTURES	MOVING PICTURES	AUDIO MEDIA	WRITTEN MATERIALS
COGNITIVE Knowledge Comprehension Application Problem-Solving	Especially useful with demonstrations. Can be used to teach -recognition and discrimination -rules, principles or sequential steps.	Very useful for all levels of cognitive instruction. Can highlight stress concepts by displaying words, lists of steps, pictures and pictorial segments. Can provide visual cues.	Useful for showing content not otherwise easily brought into the training situation. Usually too costly for presenting still visuals and/or narrative audio.	May have their greatest use when in conjunction with printed matter or projected visuals. Useful if sounds of machines, alarms, etc. must be learned. Inexpensive.	Excellent media for all levels of cognitive instruction. Relatively inexpensive, printed materials allow for self-pacing. Can be used effectively with still pictures and audio materials.
PSYCHOMOTOR	Useful for teaching and trainee practice of performance in manipulating tools and equipment. Especially appropriate for on-the-job training. People can be used to demonstrate physical actions.	Little application. Can portray static positions of moving persons or objects.	Very useful. Can be used to: -model skills requiring motion -slow motion for close examination -provide visual feedback of student performance -demonstrate processes which take place over an extended time period.	Recorded audio materials generally useful in training only when demonstrating speech or hearing-related skills.	Limited application. since motion is difficult to represent. One important use is procedure guides or checklists for skills performance.
AFFECTIVE	Limited application. May be useful if the object is the focus of the desired attitude formation.	Limited application. Slides in combination with audio materials may influence attitude formation.	Excellent for influencing attitudes. Special effects and other visual techniques are especially useful for presenting affective material.	Limited application. Possibly useful for establishing moods or attitudes with background music, special sounds, or unique narration. May be used with slides to influence attitude formation.	Very little application for training materials.

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT SEVEN
SELECTING INSTRUCTIONAL STRATEGIES

Estimated time for unit - Seven hours

The CONTENT of this unit:

This unit extends your knowledge of instructional methods by providing additional information about instructional events. The unit identifies instructional methods as one part of an instructional strategy - a prescription of specific means used to help trainees achieve different types and levels of objectives. Other parts of strategies include providing appropriate kinds of practice, reinforcing trainees, motivating trainees, and emphasizing, clarifying, and highlighting the content to be learned. The unit concludes with instruction on specific strategies for each different type and level of behavior.

The OBJECTIVES of this unit:

By the end of this unit, you will be able to:

-define each instructional strategy component
-list and give examples of the application of the rules for incorporating practice within instruction
-identify appropriate uses for each type of reinforcement
-identify effective techniques for motivating trainees
-describe techniques for clarifying, emphasizing, and illustrating important instructional content and provide an example of each
-select instructional strategy components that are appropriate for each type and level of behavior specified in an objective.

The PURPOSE of this unit:

Effective instruction is dependent upon the selection of appropriate instructional strategy components. Each type and level of behavior specified in an objective requires different combinations of components; this unit provides participants with concepts and rules for selecting appropriate strategy components to teach each type and level of behavior.

The RESOURCES for this unit:

1. Content Summary
2. Assignment 7.1 Incorporating Opportunities for Practice
3. Assignment 7.2 Feedback and Other Reinforcements
4. Assignment 7.3 Motivating Trainees
5. Assignment 7.4 Strategies for Enhancing Content
6. Assignment 7.5 Teaching Toward the Objective

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
CONTENT SUMMARY

Selecting Instructional Strategies

Learning

Learning refers to what happens inside the individual; it involves a more or less permanent change in the ability to do something that the learner could not previously do. It represents an increased ability of some kind.

a. it is internal - it occurs within the learner and cannot be directly observed; instead, it is inferred from the learner's behavior.
b. it is an increased ability to do something the learner could not previously do; it is demonstrated by some performance, some behavior, of the learner.

Instruction

Instruction refers to what happens outside the individual learner; it is the process of arranging conditions that lead to learning. Instruction includes everything a teacher or trainer does to make it possible for students to learn.

a. it is external - it occurs outside the learner and can be observed, manipulated, and changed; it may involve anything in the environment around the learner that can be used to help him/her learn.
b. it is an arranging of conditions that promote learning; the conditions may include materials, learning activities, resources, facilities, and methods. Literally, anything one does in order to help a student learn can be called instruction.

Instructional Activities

Instructional activities are things an instructor or trainer does to help students learn. There are three basic types of instructional activities.

1. selection of instructional methods and media and of learning activities - involves decisions about what should be learned, how and in what order, what materials will be provided, and how learning will be evaluated.

2. motivation of learners - involves decisions about how to involve learners in the activities, how to keep them working effectively, and how to inform them about their progress.

3. management of instruction - involves decisions about how to control the logistics of instruction, including getting materials to learners, performing housekeeping tasks, and working within the limitations of time, space, and resources.

For each basic type of activity, there are strategies for carrying out the activity. A *strategy* is a prescription for accomplishing a particular goal or objective; it is a specific statement of what means should be used to achieve a particular end.

Example: To teach trainees how to operate a slide (end/objective)
projector, give an introductory lecture
during which you identify the parts of (means)
the projector, demonstrate loading and
focusing the projector, and provide
practice in loading and focusing.

1. *Instructional Strategies* prescribes appropriate means for selecting and sequencing methods and media. This unit presents several types of instructional strategies.

2. *Motivational Strategies* prescribe appropriate means for motivating trainees. This unit presents several motivational strategies.

3. *Management Strategies* prescribe appropriate means for managing the logistics of training. Unit Ten presents management strategies.

Instructional Strategies

Each instructional strategy has several parts or components.

1. instructional method component - identifies means for communicating content to learners (see Unit 5 for a discussion of methods)
    a. lecture
    b. guided discussion
    c. demonstration
    d. adaptive instruction
2. practice component - identifies means of providing learners with opportunities to practice what they are learning
3. reinforcement component - identifies ways of providing learners with information about their degree of success in learning
4. content enhancement component - identifies techniques for clarifying, emphasizing, and illustrating the content to be taught.

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
LESSON 2 of 6: INCORPORATING OPPORTUNITIES FOR PRACTICE

ASSIGNMENT 7.1: INCORPORATING OPPORTUNITIES FOR PRACTICE

Estimated time: Fifty minutes

This assignment is concerned with means of incorporating practice within instruction. The readings will introduce basic concepts and identify general rules for incorporating practice. Accompanying exercises will allow you to try out your understanding of the concepts and rules and to demonstrate your ability to apply the rules in the design of instruction. Answers to exercises and self-checks are in the answer key at the end of the assignment. Some exercises may not have a single correct answer; rather a range of answers may be appropriate. In the answer key, you will find a suggested or representative answer; your answer should be similar to the one suggested. If you feel that your responses are greatly different from those suggested in the answer key, you may wish to consult your instructor.

OBJECTIVE: By the conclusion of this assignment, you will be able to give an example of the application of the rules for incorporating practice within a lesson.

EVALUATION: The application exercise at the end of the assignment involves you in designing practice activities that are appropriate for a lesson teaching trainees to perform a single task. Task Detailing Sheets and a Lesson Planning Form are provided.

DIRECTIONS:

1. Complete Reading #1: The Nature and Purpose of Practice. Answer the questions in Self-Check #1. This task should take approximately 10 minutes.
2. Complete Reading #2: Types of Practice. Respond to the self-checks within the reading. This task should take approximately 30 minutes.
3. Complete the application exercise using the Task Detailing Sheet and Lesson Planning Form provided. This task should take approximately 10 minutes.
4. Discuss your responses to the application exercise with your instructor and fellow participants.

READING #1: THE NATURE AND PURPOSE OF PRACTICE

This brief reading introduces you to the nature and functions of practice. First, the concept of practice is explained; then, three functions of practice are discussed. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. define practice, in your own words
2. list three functions of practice and briefly explain each.

1. Practice: A definition. Practice is an opportunity for the learner to use the skills and knowledge s/he is acquiring. Practice is a participative activity which involves the learner actively in doing, rather than passively in receiving. Practice thus allows learners to employ new skills and knowledge, gain experience in doing, and discover how well they understand what they are learning.

2. The functions of practice. Practice experiences have three functions. First, practice refines and sharpens the learning, increasing the effectivenss and efficiency of the performance. The first time you attempt to use new skills and knowledge, you are slow and uncertain. Your initial practice experience must be guided by the instructor, who prompts you by reminding you of what to do next and how to do it. The second experience is a little smoother and faster; less external guidance from the instructor is needed. Succeeding practice experiences result in sharper and more facile actions. Finally, you can perform the task effectively (with no errors) and efficiently (in minimal time). Thus practice refines and sharpens learning by making the performance more effective and efficient.

practice sharpens learning

A second function of practice is to deter forgetting. The more often you do something, the more firmly you fix it in your mind. As you continue to use the skill or knowledge, you strengthen your memory of it. The more you work to remember, the less likely you are to forget.

However, the reverse is also true. The less you use skills and knowledge, the more likely you are to forget them. For this reason, many occupations require that their members take refresher courses and obtain periodic recertification. In this manner, personnel are helped to practice important skills and knowledge so that they will not be forgotten. Thus, practice deters forgetting.

practice deters forgetting

practice improves transfer

The third function of practice is to improve the transferability of the learning. Transfer is the term used to describe the learner's ability to apply skills and knowledge in a new context. Transfer occurs when you learn a skill in the classroom and then can use that skill on the job. In the widest sense, transfer occurs when an individual can respond effectively to a new situation by applying what s/he has learned previously in other situations.

For example, when a child learns to play the piano, s/he learns what keys to strike to play different notes and how to read music. When that same child learns, some time later, to play the guitar, s/he transfers his/her skill in reading music and finds it easier to learn to play the guitar. The more widely a skill or knowledge is practiced, the more varied the contexts of practice experiences, the more effective and efficient the learning, and the more easily similar skills and knowledge can be learned. Thus practice increases ability to transfer skills and knowledge.

What are some other specific benefits of good practice experiences? Efficiency is developed. With each successive practice opportunity, the learner requires less time per task and makes fewer errors. Discrimination improves. The learner not only moves closer and closer to the desired performance, but also develops the ability to distinguish correct from incorrect performances, to evaluate and correct his/her own performance, and to handle more difficult levels of activities.

Summary. Practice opportunities have central importance in good instruction. Practice involves learners in using the skills and knowledge they are learning. Through practice, learners refine and sharpen the learning, deter forgetting, improve transferability, develop efficiency, and improve discrimination. Now that you understand why it is important to provide practice opportunities, we will look at some different types of practice and the uses of each.

SELF-CHECK #1

Answer each of the following without looking at the answer key. Then check your answers with the key.

1. What is practice? Define the term in your own words.

2. What are three functions of practice? Briefly explain each.

READING #2: TYPES OF PRACTICE

This reading introduces some major issues concerning types of practice activities. It includes discussions on matching practice tasks to desired final performances, using progressively more rigorous standards of performance during practice, scheduling practice, providing assistance during practice, and using actual versus simulated practice.

By the conclusion of this reading, you should be able to:

1. match a practice activity to the type and level of behavior required in the final performance
2. design a practice activity that incorporates progressively more rigorous standards of performance
3. design a practice activity that employs the parts-to-whole structure
4. plan to provide assistance during practice
5. describe a simulated practice activity that is relevant to your training situation.

1. Matching practice tasks to the desired performance. Trainees must be able to practice performing the type and level of task that will be required of them on the job. For example, if the job requires them to assemble equipment for use in performing a chemical test, then trainees must have practice in assembling the equipment. It is not enough merely to have them describe how they would perform the assembly; they must actually do it. If job performance requires the selection and use of a formula, then trainees must have practice in both selecting and using formulae.

Practice experiences must be designed to provide a sequence of activities that lead to the final desired performance. Practice may begin on a very simple level if the final expected performance is very difficult or is composed of multiple or complex parts; however, the final practice activity must require the trainee to perform the exact type of task required on the job, under the same conditions as the job. The assessment activity must match the final performance standard exacted during practice.

match type and level of behavior

There are two issues involved in matching practice and on-the-job tasks. First, the type and level of behavior required on the job must be incorporated in practice. For example, if the trainee will be expected to conduct tests for the presence of mercury in a solution, then s/he must be given practice on performing the required tests. If the trainee is merely required to list the steps of the procedure for carrying out a test, then practice must focus on listing activities. The type and level of behavior required as a result of training must be incorporated during practice activities.

provide multiple contexts

Second, all possible contexts or conditions under which the desired skills and knowledge will be utilized on the job must be represented during practice. If the trainee must be able to perform chemical tests both in the field and in the laboratory, then practice opportunities must be provided in both field and laboratory situations.

Rules for Matching Practice Tasks to Desired Performance.

1. Match the type and level of behavior required during on-the-job performance to the type and level provided during instruction.
2. If the final performance is highly complex or difficult, sequence practice activities, beginning with simple sub-tasks and concluding with the final complete performance.
3. Provide practice conditions that are similar to the situations and conditions existing on the job.

Example. You are teaching trainees to write behavioral objectives. Your objective is that trainees will be able to write a behavioral objective in the correct format for each type of learning--cognitive, affective, and psychomotor. Since the final desired behavior is a cognitive application performance, you provide practice in both using the correct format and in writing three different types of objectives. You provide practice first in the correct format; after trainees have mastered that, then you provide practice in writing, first, cognitive objectives, then affective objectives, and last psychomotor objectives.

Exercise. You are teaching trainees to prepare water samples for chemical analysis. The objective of the lesson is that trainees will be able to determine the correct weight of each sample. Briefly describe how you would match practice opportunities to the desired type and level of final performance.

use increasingly rigorous standards

2. Standards of Performance. Another way to examine practice opportunities is in terms of the standards of performance against which trainee performance is judged. A performance standard is a criterion such as the maximum time a task may take, a minimum acceptable test score, or a tolerance range. In some job situations, an absolutely correct response is the only one permitted. However, an approximately correct response may be entirely appropriate for an initial practice experience, since the instructor will relax the standards for the trainee. For example, a chemical test may involve the calculation of residue weight within a very narrow range. On the initial practice experience, however, trainees may be permitted to report as correct weights that lie within a much broader range. After each attempt at weighing the sample, the range may be reduced until

trainees are performing at the standard required for on-the-job performance. For each exercise, a slightly higher standard of performance is thus required until desired levels are reached.

vary time

On some tasks, time can be used to measure performance. Although the final performance standard may require the trainee to complete a task within a certain time limit, initial practice activities may allow unlimited time. As the trainee becomes more proficient, the time limits can be reduced until the trainee is performing within the required limits.

Rules for Utilizing Standards of Performance.

1. When appropriate, lower performance standards for initial practice activities; increase standards as performance becomes more proficient.
2. Use "time allowed" as a performance standard; begin by allowing unlimited time and decrease allowed time as performance becomes more proficient.
3. Always make final performance standards clearly understood so that trainees will use those standards as a goal during practice activities.

Example. You are teaching trainees to operate a spectrophotometer. They must be able to prepare test samples and operate the equipment fairly rapidly, since they will be using these procedures often. You begin by allowing each trainee to work slowly and carefully, taking all the time s/he needs. However, you inform trainees that they must be able to perform 10-15 tests daily. During initial training experiences, trainees work so slowly that they are only able to complete 4-5 tests daily. However, after a two-day training session, they have increased proficiency to 8-10 tests daily. Since they have not yet reached the desired level of proficiency, you incorporate two more days of practice. At the end of the fourth day, all trainees are performing at the desired level.

Exercise. Explain how you would apply the rules for using performance standards as practice tools during instruction on operating a piece of equipment relevant to your work situation.

3. Scheduling practice activities. Practice activities should be scheduled according to the size and complexity of the task to be learned. Very large and/or very complex tasks should be broken into smaller manageable segments on which trainees may practice. Practice should be provided on each segment (which may be a subtask, a step, or a smaller unit) first, and then on the whole task. For example, training in the operation of a very complex piece of equipment might include instruction and practice separately on each phase of operation. Only after trainees are proficient on each phase should they begin to practice putting the phases together into a whole task. This parts-to-whole structure serves two purposes. First, it allows trainees to master skills and gain knowledge in small, manageable amounts. Second, it allows both trainee and instructor to pinpoint and correct specific errors before those errors become learned performances.

use parts-to-whole structure

You should remember, however, that trainees need to be aware of and to practice the whole task as well as the parts. Practice opportunities, therefore, should be scheduled appropriately to allow trainees to master sequential skills, to deal with manageable units, and to practice the whole task. Trainees should be made aware of the nature of the whole task so that they will understand how the parts fit together. For fairly simple, small tasks, whole practice will be sufficient.

Rules for Scheduling Practice Activities

1. For small or fairly simple tasks, provide practice on the whole task.
2. For large or complex tasks, provide practice first on those parts which are new or difficult.
3. For large or complex tasks, provide practice on the whole task after trainees have mastered the parts.
4. Arrange instruction and practice sequentially so that task steps are mastered in correct sequences. Make trainees aware of the nature of the whole task while they are learning the parts. Ensure that trainees master the whole task in the appropriate sequence.

Example. You are giving your daughter her first driving lesson. You want her to learn how to start the car and put it into gear. First, you list the steps of the task. Then you give her practice in starting the car, including practice on operating the clutch. After she has begun to master the clutch and gas pedal co-ordination, you teach her the locations of the various gears. Finally, you have her practice all the skills in their correct order.

Exercise. Briefly describe how you would incorporate the parts-to-whole structure of practice during a training sesson on the operation of a pH meter or a piece of equipment with which you are familiar.

4. Providing assistance during practice. Two kinds of assistance are involved: prompting and cueing the trainee before the trainee makes a response and providing feedback after the response.* Prompting or cueing is a form of preliminary assistance and should be provided generously during initial practice activities; then the prompts should be diminished gradually until the learner is able to perform the task without any preliminary assistance. The more complex or difficult the task, the more preliminary assistance will be needed.

use prompts and cues

Prompts and cues can be built into the descriptions of activities. For example, the initial practice activity for a lesson in designing effective overhead transparencies may include the following directions: "Design an overhead transparency to clarify a procedure. Use the six principles of effective design in your work." Later experiences may omit the second, prompting sentence. Alternately, the instructor may wait until the trainee appears to be having difficulties in making the desired response before providing the prompt ("Remember the six principles of effective design.")

Fellow trainees may provide prompts and cues as well as the instructor. However, trainee dependence on prompts and cues should be gradually diminished until trainees can perform the desired task without any assistance.

Rules for Providing Assistance During Practice.

1. Provide assistance for initial practice activities in the directions to trainees for completing assignments and exercises. The prompts and cues may be given orally or in writing.
2. Gradually diminish the amount of assistance until trainees can perform adequately without them.
3. Whenever appropriate, allow trainees to prompt each other. One can perform the task while the other supervises and prompts; then they should exchange roles.
4. Cue performance; don't perform for the trainee. Provide guidance, directions, and examples as necessary but require the trainee to respond to the task rather than watch you perform it for him/her.

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*We will examine notions of feedback in Lesson Three.

Example. During a lesson on performing task analyses, you incorporate practice on identifying the type of behavior required at each step. You ask one trainee to identify the type of behavior involved in calibrating a pH meter. For the initial practice experience, you may include the following prompt in your question: "What type of behavior is involved in this task---is it cognitive, affective, or psychomotor?" After two or three such questions, you no longer include the prompt.

Exercise. You plan to teach a lesson in identifying problems that require a training solution. One of the practice activities requires trainees to identify symptoms of each type of performance problem from the problem analysis statements. Create a prompt that you might use to help trainees respond correctly to the activity.

simulate complex or unpredictable experiences

5. Actual versus Simulated Practice. It is often difficult or impossible to arrange for all practice experiences to take place in the situations under which assessment and on-the-job tasks will be performed. In these cases, simulated practice opportunities may be provided. A simulation involves creating an artificial context or situation for the use of skills and knowledge. For example, many driver-training programs make use of a driving simulator on which students begin to practice driving skills. Once students have mastered basic skills and have begun to demonstrate appropriate reactions to simulated driving situations, they are first allowed behind the wheel of a real car.

   Complicated equipment can often be simulated, as can emergency situations whose occurrence cannot be predicted but for which personnel must be prepared. Remember the simulated disaster drills by which medical, police, and fire personnel practice dealing with real emergencies. Simulations, if well designed and executed, can be extremely effective and useful practice tools.

   Simulated experiences can serve to prepare trainees for actual experiences which are costly and difficult to provide and can give practice in dealing with situations that can not be expected to occur predictably in actuality but which must be prepared for. Whenever possible, simulated practice should be followed by actual-situation practice.

   Rules for Using Simulations.

   1. Use simulations to prepare trainees to cope with unexpected or emergency conditions.
   2. Use simulations when it is too difficult or too costly to provide actual situations for practice experiences.
   3. Whenever possible, follow simulations with actual-situation practice.

Example. Your department is extremely concerned about safety. Conversations with subordinates indicate that most personnel are unaware of the locations of firefighting equipment such as fire extinguishers and sprinkler control valves. No one is sure how best to escape from the work area if a fire should occur. You decide to hold a series of short meetings on the location and use of equipment and on appropriate measures for evacuating the work area safely. To reinforce the information, you also desire to hold monthly simulated fire and disaster drills to ensure that personnel will act appropriately if a real disaster occurs.

Exercise. Briefly describe a training need which might effectively utilize simulated practice experiences. Indicate how the simulation would occur.

ASSIGNMENT 7.1

Answer Key

Included here are suggested answers to the self-check. Your answers should be similar to the ones suggested.

SELF-CHECK #1

1. Practice is any opportunity given to a learner to use the skills and knowledge s/he is learning; thus it is a participative activity which gives learners experience in doing.

2. The three functions of practice are to sharpen learning, to deter forgetting, and to improve transfer.

    a) practice sharpens learning by increasing the effectiveness and efficiency of the performance. Each time one performs a task, the performance is more accurate or correct and faster.
    b) practice deters forgetting by using repetition to fix a skill or knowledge more firmly in the person's mind.
    c) practice improves transfer by providing multiple contexts in which a skill or knowledge can be practiced.

APPLICATION EXERCISE

You are teaching trainees to perform the suspended solids test. You have completed the Task Detailing Sheet and Lesson Planning Form, which are enclosed. Briefly indicate how you would design practice experiences for this lesson that will incorporate the rules you have just learned.

A summary list of rules is enclosed for your convenience.

TASK DETAILING SHEET

A. Write Job Title Chemist, Wastewater Treatment Plant

B. Write Task Perform suspended solids test

Complete steps C - F in the space below.

C. List the specific steps required to perform the task.
D. Check each step which needs to be taught.
E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.
F. For a cognitive behavior, indicate the appropriate level of performance:
  Knowledge - ability to recall information or procedures
  Comprehension - ability to explain information or procedures
  Application - ability to use information or procedures to do something
  Problem Solving - ability to develop new information or procedures

C Steps Required to Perform Task	D Needs to be Taught	E Type of Behavior: Cognitive, Affective, Psychomotor	F Level of Cognitive Behavior: Know., Comp., Appl., P. S.
(1) Gather equipment		Cognitive	knowledge
(2) Prepare filter	✓	Cognitive	application
(3) Measure sample	✓	Cognitive	knowledge
(4) Filter sample		Cognitive	knowledge
(5) Dry residue		Cognitive	knowledge
(6) Allow residue to cool		Cognitive	knowledge
(7) Weigh residue & filter	✓	Cognitive	application
(8) Record weight of residue		Cognitive	knowledge
(9) Repeat steps 5, 6, 7		Cognitive	knowledge
(10) Check consistency of weight of residue and filter	✓	Cognitive	application
(11) Calculate weight of residue	✓	Cognitive	application
(12) Record weight of residue		Cognitive	knowledge

LESSON PLANNING FORM

Job Title Chemist Wastewater Treatment Plant Task Perform Suspended Solids Test

Step (#10) Check weight of residue and filter

Type and Level of Behavior application
(as appropriate)

1) Instructional Objective:

Audience Chemists in Wastewater Treatment Plants

Behavior Will be able to confirm weight of residue and filter

Conditions Given an analytical balance and a previous measure of weight

Acceptable Performance The first and second weights must agree within 0.0005 grams

2) Entering Competencies: Is familiar with the equipment, can prepare and filter sample, and dry residue

3) Evaluation Activities: Rating Scale

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s) lecture, demonstration, assignment

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available
objects	lab equipment and sample

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1. give lecture to describe steps and procedures
2. demonstrate procedure
3. have trainees practice procedures on given samples (of which you know weight)

SUMMARY OF RULES FOR INCORPORATING PRACTICE IN INSTRUCTION

Rules for Matching Practice Tasks to Desired Performance.

1. Match the type and level of behavior required during on-the-job performance to the type and level provided during instruction.
2. If the final performance is highly complex or difficult, sequence practice activities, beginning with simple sub-tasks and concluding with the final complete performance.
3. Provide practice conditions that are similar to the situations and and conditions existing on the job.

Rules for Utilizing Standards of Performance.

1. When appropriate, lower performance standards for initial practice activities; increase standards as performance becomes more proficient.
2. Use "time allowed" as a performance standard; begin by allowing unlimited time and decrease allowed time as performance becomes more proficient.
3. Always make final performance standards clearly understood so that trainees will use those standards as a goal during practice activities.

Rules for Scheduling Practice Activities.

1. For small or fairly simple tasks, provide practice on the whole task.
2. For large or complex tasks, provide practice first on those parts which are new or difficult.
3. For large or complex tasks, provide practice on the whole task after trainees have mastered the parts.
4. Arrange instruction and practice sequentially so that task steps are mastered in correct sequences. Make trainees aware of the nature of the whole task while they are learning the parts. Ensure that trainees master the whole task in the appropriate sequence.

Rules for Providing Assistance During Practice.

1. Provide assistance for initial practice activities in the directions to trainees for completing assignments and exercises. The prompts and cues may be given orally or in writing.

2. Gradually diminish the amount of assistance until trainees can perform adequately without them.

3. Whenever appropriate, allow trainees to prompt each other. One can perform the task while the other supervises and prompts; then they should exchange roles.

4. Cue performance; don't perform for the trainee. Provide guidance, directions, and examples as necessary but require the trainee to respond to the task rather than watch you perform it for him/her.

Rules for Using Simulations.

1. Use simulations to prepare trainees to cope with unexpected or emergency conditions.

2. Use simulations when it is too difficult or too costly to provide actual situations for practice experiences.

3. Whenever possible, follow simulations with actual-situation practice.

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
LESSON 3 of 6: USING FEEDBACK AND OTHER REINFORCERS

ASSIGNMENT 7.2: USING FEEDBACK AND OTHER REINFORCERS

Estimated time: Forty-five minutes

This assignment is concerned with various types of reinforcement and the attributes of each. Readings introduce basic concepts and identify general rules for utilizing reinforcement techniques. Accompanying self-checks allow you to try out your understanding of concepts and rules. Answers to the self-checks are in the answer keys at the end of the assignment. Some questions may not have a single correct answer; rather, a range of answers may be appropriate. In the answer key, you will find a suggested or representative answer; your answer should be similar to the one suggested. If you feel that your responses are greatly different from those suggested in the answer key, you may wish to consult your instructor.

OBJECTIVE: By the conclusion of this assignment, you will be able to identify appropriate uses for each type of reinforcer.

EVALUATION: Self-checks within the assignment will help you to evaluate your understanding of concepts of reinforcement.

DIRECTIONS:
1. Complete Reading #1: The Nature of Reinforcement. Answer the questions in Self-Check #1. This task should take approximately 5 minutes.
2. Complete Reading #2: Types of Reinforcers. Answer the questions in Self-Check #2. This task should take approximately 10 minutes.
3. Complete Reading #3: Characteristics of Reinforcement. Answer the questions in Self-Check #3. This task should take approximately 10 minutes.
4. Complete Reading #4: Feedback. Answer the questions in Self-Check #4. This task should take approximately 10 minutes.
5. Discuss any concerns and problems you may have about the concepts and rules for providing reinforcement with your instructor and fellow participants. The discussion should last approximately 10 minutes.

READING #1: THE NATURE OF REINFORCEMENT

This brief reading introduces you to the nature and purpose of reinforcement. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. define reinforcement
2. identify situations requiring the use of reinforcement.

1. Reinforcement: A definition. Reinforcement is the process of guiding behavior by the use of rewards and punishments. A reinforcer is any event that changes the probability of the occurrence of some behavior. The event may be a statement of praise, a grade, a salary bonus, a criticism, or a disciplinary action. When the reinforcing event occurs immediately after some behavior, it affects the probability of the occurrence of that behavior. For example, if you are teaching your dog to heel, a pat on the head or a dog biscuit offered immediately after the dog has obeyed your command will increase the probability that the dog will obey your next command to heel.

2. Situations requiring reinforcement. Reinforcement plays an important part in the education of humans, both in and out of school. Parents use reinforcers to guide the behavior of their children; teachers use reinforcers to motivate and discipline students; individuals use reinforcers to reward and punish themselves for their actions. A parent who spanks a naughty child is guiding that child's behavior by following undesirable actions with punishment. A teacher rewards good performance on a test or assignment with a high grade and words of praise. A company rewards good employee performance with salary increases and promotions. Any time a reward or punishment follows some behavior, reinforcement is being used.

SELF-CHECK #1

1. The process of guiding behavior by the use of rewards and punishments is called

   ______________________.

2. When should a reinforcer occur if it is to be most effective?

3. Which of the following situations would probably never involve reinforcement? _____

   a. a parent teaches her child to make his bed every day
   b. a department plans to increase its workers' productivity
   c. an instructor teaches a class to remain quietly in their seats
   d. none of the above

READING #2: TYPES OF REINFORCERS

This reading introduces the concepts of positive reinforcement, negative reinforcement, and punishment. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. define and give a training-situation example of the use of each of the three kinds of reinforcement.

There are three basic types of reinforcers: positive reinforcers (often called rewards), negative reinforcers, and punishment. Each type is used differently and has different effects.

presence of reward reinforces behavior

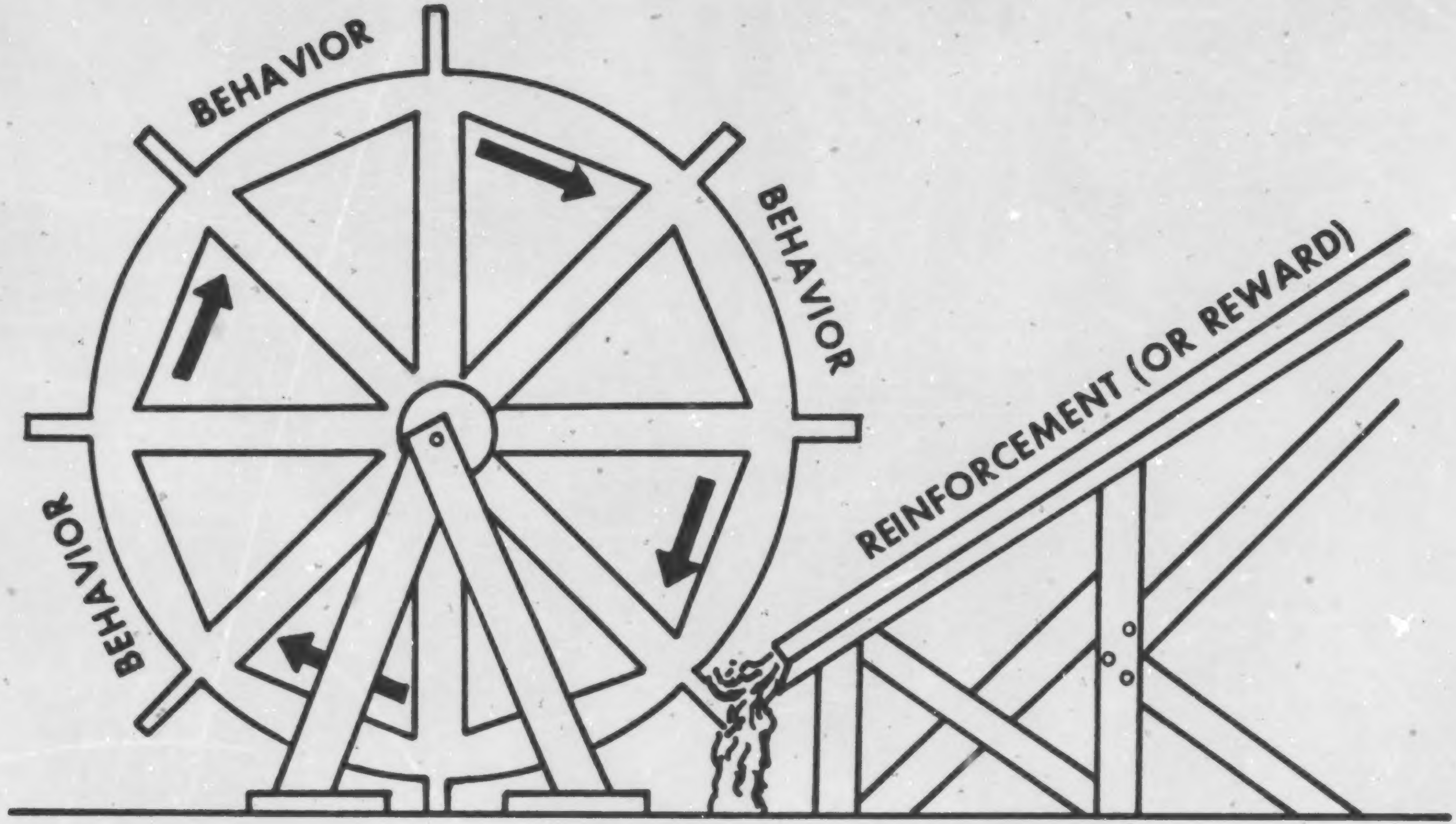
Positive Reinforcement. A positive reinforcer or reward is an event that increases the probability of the occurrence of the behavior that it follows. If a trainee has studied hard for a test and earns a high grade on the test, she will probably study hard for the next test. The grade is a reward which increases the probability that the trainee will repeat the behavior (studying hard) that earned the high grade. There are many types of positive reinforcers or rewards, including praise, salary bonuses and increments, promotions and peer recognition. Rewards strengthen the behavior which they follow since behaviors which have been rewarded tend to be repeated (see Figure 1).

removal of unpleasant event reinforces behavior

Negative Reinforcement. A negative reinforcer is an unpleasant event whose removal increases the probability of the occurrence of the behavior which caused its removal. An employee who has been reporting late for work each day may have part of his salary deducted for lateness. When he begins arriving on time, the penalty is lifted and he receives full salary. The removal of the penalty is the negative reinforcement which should increase the probability that the employee will arrive on time. Negative reinforcement operates through removal of unpleasant or aversive events; the behavior which caused the removal tends to be repeated.

Punishment. A punishment is an event which decreases the probability of the occurrence of the behavior which occasioned the punishment. An unruly student who misbehaves in class may be punished by being kept after school. If that punishment prevents the student from engaging in desirable after-school activities, she will learn to avoid behaving in the manner which resulted in the punishment. Punishment thus serves to reduce the occurrence of the undesirable behavior (see Figure 2).

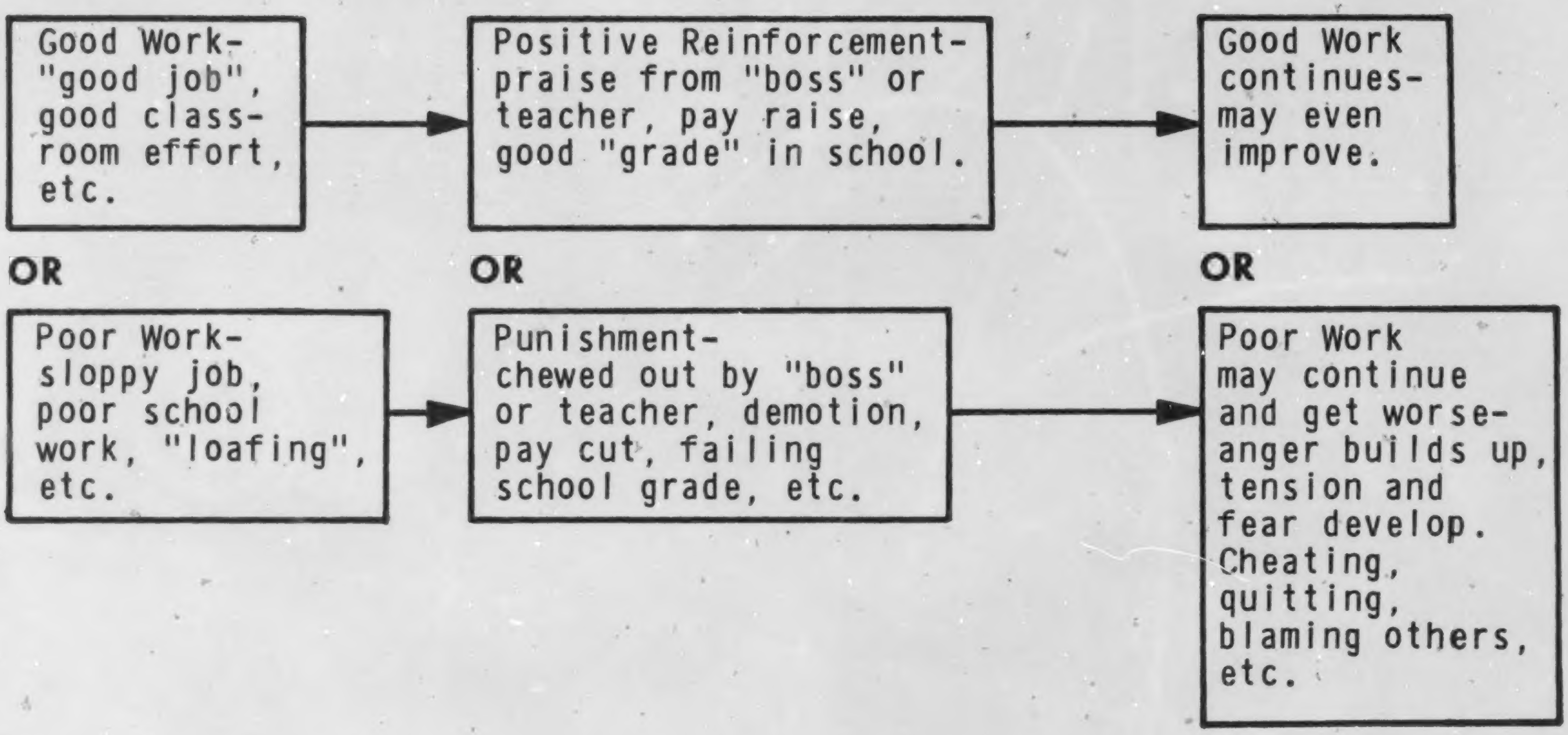
LAW OF REINFORCEMENT



ANY FORM OF BEHAVIOR THAT IS REWARDED WILL BE MORE LIKELY TO BE REPEATED.

Figure #1

Results of Praise & Punishment



Good Work- "good job", good classroom effort, etc.

Positive Reinforcement- praise from "boss" or teacher, pay raise, good "grade" in school.

Good Work continues- may even improve.

OR

OR

OR

Poor Work- sloppy job, poor school work, "loafing", etc.

Punishment- chewed out by "boss" or teacher, demotion, pay cut, failing school grade, etc.

Poor Work may continue and get worse- anger builds up, tension and fear develop. Cheating, quitting, blaming others, etc.

Figure #2

SELF-CHECK #2

1. How does a positive reinforcer affect the behavior it follows?

2. Positive reinforcers are also called ____________________.

3. Suggest three different positive reinforcers you might use during a training session you are conducting.

4. How does a negative reinforcer affect the behavior it follows?

5. How does punishment affect the behavior it follows?

6. Suggest two types of punishments that might be appropriate for reinforcing poor performance during training sessions.

7. Match each type of reinforcer at the right to the situations described on the left. Types of reinforcers may be used more than once.

____ a) increased productivity earns a raise in salary

____ b) after losing 25 lbs., Mr. Smith buys a new suit

____ c) poor grades in school cause Jeff to lose his scholarship

____ d) the rescue of a drowning child earns Frank a certificate of merit from the police department

I. Positive Reinforcer

II. Negative Reinforcer

III. Punishment

(continued on next page)

____ e) constant arguments with her supervisor and fellow workers resulted in Mary's being passed over for a promotion

____ f) Laura's mother hid Laura's ice skates until Laura's school grades improved; then Laura got her skates back

READING #3: CHARACTERISTICS OF REINFORCEMENT

This reading delineates some general characteristics of reinforcement and lists rules for using reinforcement. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. describe effective methods for providing reinforcement during training, using the rules.

reinforce immediately

There are several characteristics of good reinforcement. First, reinforcers are most effective when they immediately follow the behavior that they are intended to reward or punish. The longer the interval between the behavior and the reinforcer, the less likely the individual is to make the connection between the two.

clearly identify reinforcement structure

Second, the nature of the reinforcements must be clearly identified. Inappropriate or undesirable behaviors must be clearly identified as such; the consequences (i.e., punishments) must be clearly spelled-out so that trainees know what to expect. Equally, the characteristics of desirable performance must be made known and the rewards clearly identified. In part, this involves making known the standards for acceptable performance, the criteria against which performances will be judged, and the reward and punishment structure (i.e., grading policies, promotion and salary requirements, evaluation procedures and standards). For example, trainees should be informed about grading policies and performance standards as they begin training; subordinates should be informed of evaluation procedures and standards before they are evaluated; objectives should be clearly spelled out; and reward and punishment structures and policies publicized.

reinforce consistently

Third, reinforcement should be provided consistently. Consistency involves maintaining the standards, criteria, and reinforcement structures that the instructor or superior has established. Similar behaviors under similar circumstances should receive similar reinforcements. This principle is especially important when punishment is employed. Two trainees or subordinates who display similarly undesirable actions should both be punished; punishing one and ignoring the other results in an ineffective reinforcement system.

reinforce regularly

Fourth, reinforcement should be provided regularly. Any type of reinforcement gives an individual some information about the appropriateness that occasioned the reinforcement. Without reinforcement, the individual is unable to determine whether his performance is appropriate or not; in the absence of the information provided by reinforcement, he is unable to decide whether to repeat a given action or perform a different one. Therefore, some kind of reinforcement should be provided so that trainees and subordinates can judge the appropriateness of their behavior. For example, rewards need not always be in the form of grades. A word or two of praise is equally effective. Fellow trainees can provide reinforcement as well as the instructor. Instructional materials themselves can contain reinforcment. In fact, once a trainee or subordinate becomes proficient at a task, s/he can provide much of his or her own reinforcement by acknowledging a task well-done or by identifying an error in performance. To assist the individual, the trainer or supervisor can provide answer keys, checklists, and evaluation criteria so that the individual can judge and reinforce his or her own efforts.

different types of reinforcers have different effects

Fifth, the three basic types of reinforcers (positive reinforcers or rewards, negative reinforcers, and punishment) have different effects. Positive reinforcers are most useful in directing and controlling behavior. They increase the strength of the behaviors they follow. The effects of punishment are uncertain; punishment is not always effective in reducing undesired actions. Particularly with adults, punishment is often less useful than counselling the individual about the undesired behavior. However, counselling carries its own hazards. For serious, long-term problems, only a trained counsellor should attempt the counselling process. For occasional problems, an out-of-class conference between instructor and trainee or between superior and subordinate may help to identify and correct the problem. Punishment should never be used when trainees are having learning problems; punishment should only be used with discipline problems, both during training and on-the-job. Punishment should always be followed by negative reinforcement when the undesirable or inappropriate behavior has ceased. Individuals need to be visibly reassured that their efforts to improve are recognized.

General Rules for Reinforcement

1. Reinforcement should occur immediately after the behavior or action that is to be reinforced. The longer the delay, the less effective the reinforcement.

2. Reinforcement structures should be made explicit. Performance standards and criteria should be clearly identified, as should assessment procedures and consequences.

3. Reinforcement should be consistent. Standards, criteria, and reinforcement structures should be applied consistently and regularly.

4. Reinforcement should be provided regularly. Individuals need some means of judging the appropriateness and adequacy of their actions.

5. Punishment and negative reinforcement should be used sparingly and with care. Positive reinforcement should be used whenever possible.

SELF-CHECK #3

1. Why is it important to provide reinforcement regularly?

2. Why is it important to be consistent in providing reinforcement?

3. Which of the following are useful sources of reinforcement during training? ________

   a) the instructor
   b) answer keys in instructional materials
   c) fellow trainees
   d) a and b
   e) a, b, and c

4. How can you, a trainer, identify the reinforcement structure for your trainees? Suggest two or three ways.

5. Read the following scenario. Then suggest ways in which Gary's instructor can utilize all three types of reinforcement--positive, negative, and punishment--to help Gary improve his situation.

   Gary has been sitting at the back of the room during the entirety of the first week of a month-long training session you are conducting. He does not participate in class discussions, nor turn in assignments on time; nor does he appear to understand the procedures you are teaching. You have reminded him several times of his responsibility toward the training session and informed him that failure in the training program will result in job termination (he is a new employee undergoing pre-employment training). He has not responded to your warnings. You decide to submit a formal report to his department supervisor and to the personnel department; you give a copy of that report to Gary during a conference with him.

READING #4: FEEDBACK

This reading introduces concepts of feedback and lists rules for incorporating feedback within instruction. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. define feedback
2. define and differentiate between confirmatory feedback and constructive feedback.

1. Feedback: A definition. One of the most important ways of providing reinforcement is through feedback. Feedback involves providing information about the success or appropriateness of behavior. In a sense, all reinforcement is feedback of one sort or another. For our purposes, however, we can define the term more narrowly. Feedback is providing verbal information about a behavior that leads an individual to approve of or modify that behavior. Feedback may be given in oral or written form, but it must contain verbal indicators of the success or appropriateness of some behavior. Salary increases, grades, promotions, and the like are not considered feedback as we have defined the term.

confirmatory feedback

constructive feedback

2. Types of Feedback. There are two basic types of feedback: confirmatory and constructive. Confirmatory feedback involves the use of words which express approval or disapproval about actions; saying "good work" or "that's wrong" is providing confirmatory feedback. Constructive feedback involves providing verbal directions for maintaining or modifying a behavior. Telling a trainee "no; you must hold the beaker in your left hand in order to read the metric volume of that solution" is providing constructive feedback. Obviously, constructive feedback requires more, and more specific, information than does confirmatory feedback; constructive feedback is therefore more useful for learning situations than confirmatory feedback, especially during the initial stages of learning.

problem orientation

Characteristics of Constructive Feedback. Effective constructive feedback has several important characteristics. First, it is always problem-oriented, never personality-oriented. It focuses on solving problems by identifying the precise problem or difficulty and recommending specific ways of resolving it. Constructive feedback should never attack the individual; it can and should be highly critical, but the criticism must be objective and impartial. It is constructive--it helps to build skills and knowledge by pointing out problems and ways to begin solving them.

tailor feedback to meet trainees' needs

Second, constructive feedback should be tailored in quality and quantity to the trainee's or subordinate's progress and status. During initial learning experiences, for example, trainees should receive fairly detailed and frequent feedback on their performance; as they become more proficient and more confident, the quantity of constructive feedback can be decreased. Eventually, only confirmatory feedback will be needed. Similarly, an employee's need for detailed information about performance may vary with the task; for unfamiliar or infrequently performed or very complex tasks, detailed constructive feedback may be necessary; for fairly simple or routine tasks, confirmatory feedback will usually be adequate. The instructor or superior may want to ask each individual how much information s/he needs in order to improve performance.

reinforce proficiency

Third, even those who are performing well need to be informed of this fact. Recommending an employee for a promotion or raise or giving a trainee a high grade is less effective than informing the individual of the planned reward. The immediacy and directness of the verbal information may have greater reward potential than the actual reward itself since the verbal contact comes at a more personal level.

utilize various sources of feedback

Fourth, feedback may come from many sources. The most obvious source is the trainer or supervisor. However, feedback from peers, such as may occur during discussions or peer evaluations, can be equally effective. Peer tutors have a history of successful use and can help an instructor to more adequately meet the needs of trainees. In addition, feedback can be built into instructional materials. Answer keys and self-correcting exercises and tests provide trainees with immediate feedback and enable them to correct errors quickly. One type of instructional material, called Programmed Instruction, makes extensive use of self-correcting instructional materials by providing answers immediately after questions and exercises. Whenever there exists the possibility that a trainee may not understand why an answer is incorrect, the answer key should contain an explanation of the reason for the correct response.

For the employee, performance evaluation forms which indicate both task competence and suggestions for improving performance are far more useful than simple ratings. These can be completed by supervisors, knowledgeable fellow workers, and by the employees themselves as self-evaluations. The more information an individual has about performance, the better able s/he is to improve it.

give immediate feedback

Finally, as with all types of reinforcement, the more immediate the feedback, the more useful it is. If an individual must wait a long time to receive feedback, s/he may forget why mistakes were made and may no longer be capable of, or interested in, correcting them.

Rules for Providing Feedback

1. Provide feedback immediately after behavior.

2. Provide detailed constructive feedback for unfamiliar, complex, or infrequently performed tasks. As individuals gain proficiency, reduce the quantity of information. Provide confirmatory feedback to maintain proficiency, competence, and interest.

3. Involve trainees and subordinates in determining how much information they need and how often they need it. Establish reinforcement schedules to meet their needs.

4. Use multiple sources for feedback. Create answer keys for exercises, quizzes, and tests. Involve trainees in evaluating each other's performance and providing feedback. Provide procedural guides and checklists for employees. Involve individuals in self-evaluation; give them feedback on their self-evaluations.

5. Use feedback to reinforce appropriate behavior. Compliment the proficient; let trainees and employees know you are aware of their successes.

SELF-CHECK #4

1. What is the difference between reinforcement in general and feedback?

2. How do confirmatory and constructive feedback differ?

3. Which of the following should not be considered appropriate sources for feedback during a training session? ______

   a) personal conference between trainee and instructor

   b) peer evaluations of an assignment

   c) answer keys and procedural guides in instructional materials

   d) none of the above

   e) a, b, and c

4. Which of the following comments are not appropriate forms of feedback? ______

   a) "You did an excellent job on this report."

   b) "You failed the test because you confused these two types of chemical processes."

   c) "That's a stupid comment!"

   d) You forgot to clean the equipment again. Your sloppiness drives me crazy."

   e) You have been late for work every day this week. Your lateness prevents our meetings from starting on time and throws the entire day's schedule off.

ASSIGNMENT 7.2

Answer Key

Suggested answers to self-checks are included below. Your responses should be similar to those suggested.

SELF-CHECK #1

1. reinforcement
2. immediately after the behavior it is intended to reinforce
3. d

SELF-CHECK #2

1. it increases the probability of the occurrence of the behavior
2. rewards
3. praise, grades, peer recognition
4. its removal increases the probability of the occurrence of the behavior which caused its removal
5. it decreases the probability of the occurrence of the behavior it follows
6. job dismissal or probation, formal written warning to supervisor or to personnel department
7. I a

   I b

   III c

   I d

   III e

   II f

SELF-CHECK #3

1. reinforcement gives people information about the appropriateness of their behaviors; regular information is important to help people know whether they are right or correct in what they are doing.
2. consistency provides the same kinds of information to people and helps them ensure that they understand the consequences of their actions; it also ensures fairness.

3. e

4. Discuss with them the standards and criteria for successful performance, the requirements of the organization and of the training program, ask them what types of rewards will be most meaningful to them. Then develop and publicize a single system of rewards and punishments that are appropriate for the tasks, the organization, and the trainees; stick to it.

5. The formal report is a kind of punishment. It is a warning to Gary that his work must improve or he may lose his job. During the conference, explain to Gary that he needs to decide whether he intends to participate in and learn from the training program; if you and he can find good reasons for him to do so, then you are ready to establish a series of small rewards for small steps toward Gary's successful participation. You may decide to send a weekly report to his department supervisor detailing Gary's successes; when he is participating and succeeding as expected, you will remove the unpleasant report from his permanent record in the personnel office.

SELF-CHECK #4

1. Reinforcement helps shape behavior by identifying appropriate and inappropriate actions in terms of the type of reinforcer each earns. Feedback, on the other hand, provides specific information that helps an individual to approve of or modify a particular behavior or course of action. Feedback thus identifies how appropriate or successful a behavior is through direct verbal information.

2. Confirmatory feedback merely indicates whether the behavior was appropriate or not; constructive feedback indicates how the behavior can be improved through specific suggestions and instructions. Constructive feedback is more precise and therefore more useful than confirmatory feedback, especially in initial learning situations.

3. d

4. c

   d

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
LESSON 4 of 6: MOTIVATION

ASSIGNMENT 7.3: MOTIVATION

Estimated time: 60 minutes

This assignment deals with the topic of motivation. The readings introduce basic concepts and general guidelines for motivating trainees. Accompanying self-checks and exercises allow you to try out your understanding of the concepts and guidelines and to apply the guidelines in designing effective motivational strategies. Answers to self-checks are in the answer key at the end of the materials. Some items may not have a single correct answer; rather a range of answers may be appropriate. In the answer key, you will find a suggested or representative answer; your answer should be similar to the one suggested. If you feel that your responses are greatly different from those suggested in the answer key, you may wish to consult your instructor.

The concluding activity for this lesson is an application exercise during which you will identify techniques for motivating trainees; you will use the guidelines delineated in the readings.

OBJECTIVE: By the conclusion of this assignment, you will be able to identify effective techniques for motivating trainees.

EVALUATION: The application exercise at the end of the assignment involves you in selecting motivational strategies that are appropriate in specified situations. (If you are using this assignment for self-study, disregard references to "discussions with fellow-participants.")

DIRECTIONS:

1. Complete Reading #1: The Nature of Motivation. Answer the questions in Self-Check #1. This task should take approximately 10 minutes.
2. Complete Reading #2: Needs and Motivation. Answer the questions in Self-Check #2. This task should take approximately 15 minutes.
3. Complete Reading #3: Characteristics of Motivation. This task should take approximately 15 minutes.
4. Participate in a discussion during which you work with fellow participants to complete the application exercise. This task should take approximately 20 minutes.

READING #1: THE NATURE OF MOTIVATION

This reading introduces basic concepts in motivation. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. define motivation
2. name at least four indicators that show an individual is motivated.

1. A Definition. An important concern in learning and instruction is the concept of motivation Very little is actually known about what motivation is; we know more about what it does. We don't create motivation; every organism comes equipped with it. We must learn how to use it--much like electricity. Let's look first at some general definitions of motivation:

motivation results in goal-oriented behavior

1. motivation arouses, sustains, directs, and integrates a persons's behavior
2. motivation acts to produce a certain kind of behavior, maintained at a definite energy level, and directed toward a specific objective
3. motivated behavior is characterized by persistence, exploratory variation, and emotional energizations.

indicators of motivated behavior

In general, we can say that the result of motivation is goal-oriented behavior. We know someone is motivated when we see that person direct his behavior toward a goal. While we can't measure motivation directly, we can determine what the goal is, how important the goal is to the individual, how much effort the individual is expending in striving toward the goal, how persistent the effort is, and what different actions and behaviors are involved in reaching the goal.

For example, Allison is dissatisfied with her job; she feels that her job is boring, she is underpaid, and she is not being permitted to use her skills and abilities. She meets with her supervisor who informs her that a job slot is open that will be challenging and interesting; however, Allison must compete with applicants from outside the organization. Further, her supervisor informs her that she must pass an examination that will require a great deal of preparation in her spare time. Since Allison wants the opportunity to advance in the organization, she is highly motivated to prepare for both the application interviews and the examination. She sacrifices her weekends and evenings for six weeks in order to study; she resigns from her bowling team and bridge club, asks her husband to take over some housework, and concentrates on preparing to take the exam and the interview. Because she is highly motivated to work hard, Allison is selected for the new position.

How does Allison's behavior demonstrate motivation? First, it is goal-oriented; all her energies are directed toward preparing for the interview and examination. The goal obviously has high importance since Allison is willing to give up leisure activities for it. She is extremely persistent over a fairly long period of time, ignoring all temptations and concentrating on her goal. All of these factors combine to form what we call motivation.

competing goals have different strengths

Another way to talk about motivation is in terms of different goals and needs and the relative strength of each when they are in competition with each other. No human being is ever lucky enough to have only one task or interest or responsibility at a time; we all operate under multiple demands. Each demand represents a goal or need of some kind; all of these demands compete with each other for our attention and effort. Thus, a major component of motivation is the kinds of choices we make about where, when, and why we should direct our efforts and energies.

For example, Allison has goals and needs that are related to her work; however, she also has a family to make demands on her time and energy. Moreover, she has friends and interests outside both job and family. Each of these areas represents some need or goal for Allison. She has a need to spend time with her family, to care for them and receive their care. Her friends satisfy other needs, as do her interests in bowling and bridge. Ordinarily, she allocates a large part of her time and energy to her family, a lesser amount to her job, and the least to her friends and recreational interests. However, for the six weeks it will take her to prepare for the examination and interview, she rearranges her priorities. She allocates the largest share toward her job, a much smaller share to her family, and almost no time or energy to her friends and recreational interests. She has made a conscious choice among all of the competing goals and needs; she has focused her energies toward only one of them.

Since we are all beset by multiple demands on our time and energy, it is important to understand how and why people make choices so that we can use our knowledge of motivation to make instruction more relevant to trainees.

SELF-CHECK #1

1. What is motivation? Define the term in your own words.

2. Although we cannot directly measure motivation, we can identify and measure some of the results of motivation. Name at least three of the indicators of motivated behavior.

3. Briefly describe a situation in which you demonstrated motivated behavior. What was your goal? What did you do to reach it?

READING #2: NEEDS AND MOTIVATION

This reading introduces Maslow's concept of a hierarchy of needs. A brief self-check follows the reading.

By the conclusion of the reading, you should be able to:

1. explain each of the five levels of Maslow's hierarchy
2. identify elements at each level that motivate you.

level 1: physiological needs

One theory of human behavior advanced by Abraham Maslow maintains that behavior is directed, and thus motivated, by different needs. In Maslow's theory, a need is a discrepancy between what one has and what one wants or ought to have. More basic needs must be satisfied before needs higher on the ladder can be dealt with. Maslow has identified a hierarchy of human needs (see Figure 1), beginning with the basic physiological needs for food, water, sleep, and sex. Until these basic needs are met, humans cannot be concerned with other, less basic needs. At this level, all human behavior is motivated toward survival. For example, to fulfill these needs, humans in our culture seek employment that provides sufficient salary to pay for food and other survival needs. Welfare and social services have been provided by both government and private agencies to ensure that people have basic tools of survival. An employee whose salary does not stretch to meet basic physiological need must either take on additonal work or change jobs in order to provide for survival. Throughout history, nations have gone to war because they lacked, or thought they lacked, sufficient land and resources to maintain the survival of their citizens.

level 2: safety needs

Once survival has been assured, the next level of needs that motivates behavior is safety needs, which include the needs for shelter, safe living and working conditions, job security, and protection from injury. At this level, behavior is directed toward goals of attaining and maintaining a safe, orderly, and dependable environment. For example, an individual who is motivated by needs at this level strives to obtain a home that satisfies his perception of adequate shelter; he may require a large salary in order to live in a delux penthouse or a smaller salary adequate for an efficiency apartment. Further, his shelter needs as a bachelor are very different from his shelter needs as a married man and father of several children. Moreover, his desire to secure a safe working environment and job security may motivate him toward activities that appear to conflict with the needs of the organization that employs him. Labor unions were formed because of needs at this level.

MASLOW'S HIERARCHY OF HUMAN NEEDS

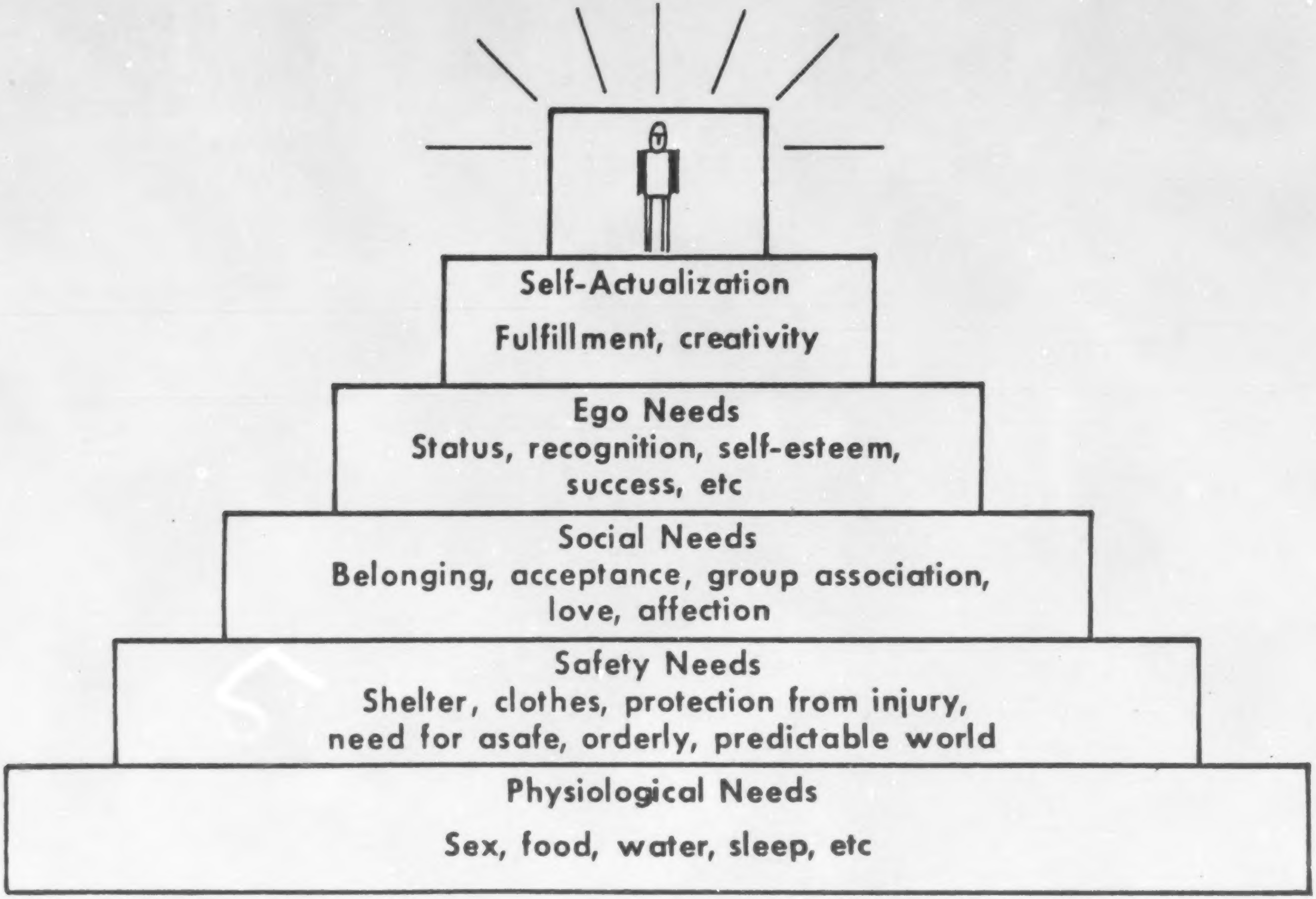

Self-Actualization
Fulfillment, creativity
Ego Needs
Status, recognition, self-esteem, success, etc
Social Needs
Belonging, acceptance, group association, love, affection
Safety Needs
Shelter, clothes, protection from injury, need for asafe, orderly, predictable world
Physiological Needs
Sex, food, water, sleep, etc

Figure 1

level 3: social needs

The third level of needs which motivate behavior is social needs, which include the need to belong to, be accepted by, and associate with a group, and the need for love and affection. At this level, people are motivated to make friends, join social groups, and participate as a member of a family. Emotional needs first begin to surface at this level. For example, an individual who is extremely poor cannot concentrate on emotional needs until she has earned sufficient salary to purchase shelter, food, clothing, and adequate medical care. Once these lower level needs are met, the individual can begin to direct her energy in additional directions; she can seek out friends, develop and share interests in recreational activities, join social groups, and begin to develop personal relationships that support her emotional needs.

level 4: ego needs

The fourth level of needs that motivate behavior is ego needs, which include the needs for status, recognition, self-esteem, and success. At this level, the individual can first begin to think of himself and of the future. At this level, too, man needs satisfactory reactions (feedback) from others as well as from himself; the need for self-respect is prominent here. Real self-respect is based on achievement; esteem needs are founded upon people's ability to achieve at tasks they believe to be important; self-respect manifests itself in feelings of self-confidence and the corresponding desire for recognition from others. In learning, trainees must experience success in training tasks; the instructor must ensure that tasks can be satisfactorily completed so that self-esteem and respect can be achieved. For example, an employee who works hard and actively seeks promotions and other forms of recognition from his organization is motivated by ego needs; he may, in fact, be earning a very large salary and appear to be greedily striving for more. However, that individual usually envisions money not as buying power but as a measure of his worth; the more money he earns, the more valuable he believes he is to the organization. Thus salary serves to fulfill ego needs for status, recognition, and respect.

level 5: self-actualization

At the highest level, the individual is motivated toward self-actualization, seeking professional and personal fulfillment and creative expression. Man must be what he can be; he remains restless unless he is doing what he thinks he is capable of doing. This is the level of needs that drives man toward his highest accomplishments; it is never completely satisfied. An interesting aspect of needs at this level is that they do not require responses from other people; the individual seeking self-fulfillment retreats from public view and works only for himself. Artists, inventors, and other highly creative individuals strive to satisfy their own inner standards of excellence, ignoring the comments and criticisms of others. It is at this stage, too, that material reinforcements become unimportant and many people leave their jobs and their familiar environments to retreat to less demanding situations in which they can concentrate solely on their creative impulses.

Maslow's hierarchy contains information that is important for trainers and employers since they must create work environments and incentives that will motivate trainees and subordinates. Offering a higher salary to an employee who is seeking opportunities for creative self-expression would be a mistake, just as encouraging risktaking and creative opportunities to an individual who cannot support his family on his present salary would be. We must understand enough about the people we work with to identify the levels of needs that serve as their most immediate and potent motivators.

SELF-CHECK #2

1. In what kind of structure does Maslow perceive human needs? Why is this an important structure for trainers and supervisors to understand?

2. In the column on the left are several descriptive statements of specific needs. In the column on the right are the five levels of Maslow's theory. Match each item on the left to its appropriate level on the right. Each level may be used more than once.

___a) Barbara wants her supervisor to recognize how well she handled a difficult client.

___b) With a new baby, Gary needs to save enough money for a down-payment on a house.

___c) Since their father lost his job, the Mally children haven't had enough to eat.

___d) Harris wants to join the softball team at his plant.

___e) Many nurses are threatening to resign if the hospital does not increase the number of security guards in the parking garage.

___f) Evelyn is planning to leave her job in order to devote all her time to earning a college degree.

___g) After three lonely weeks as the new girl at school, Joan has made two friends.

1. physiological needs
2. safety needs
3. social needs
4. ego needs
5. self-actualization

3. What goals and needs serve as your most potent motivators? What level of Maslow's theory does each represent?

READING #3: CHARACTERISTICS OF MOTIVATION

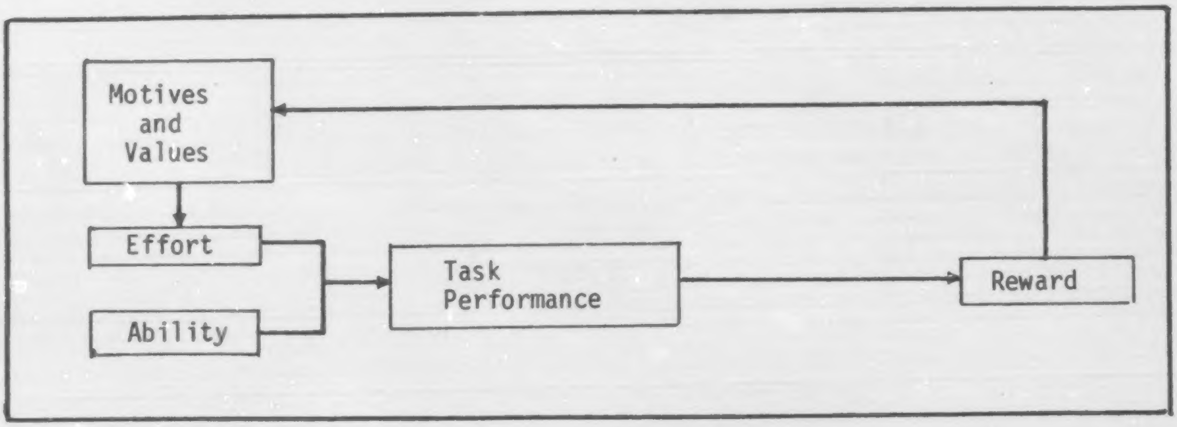
This reading identifies some basic characteristics of motivation and lists some general guidelines for increasing motivation during training. An application exercise completes the lesson assignment. Directions for the exercise are given on the Exercise Description Sheet.

By the conclusion of this reading, you should be able to:

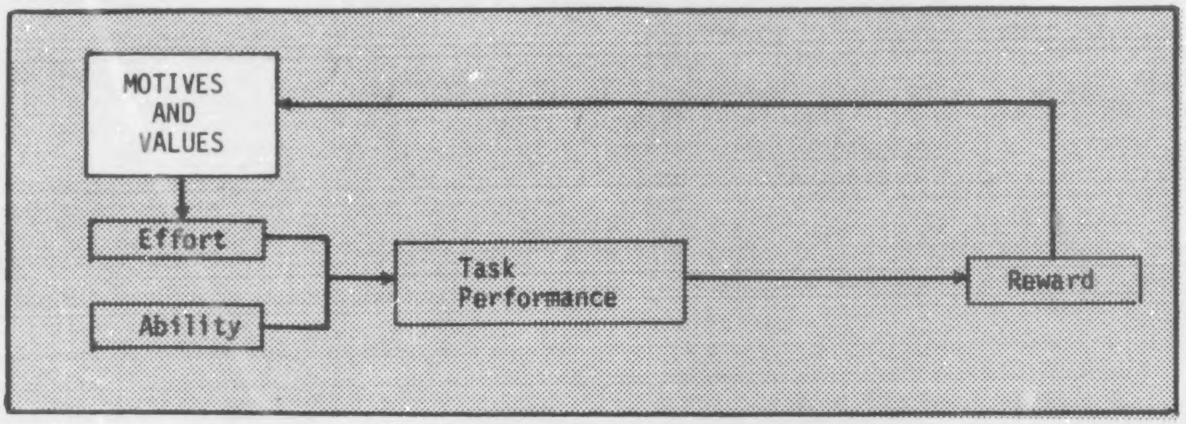
1. describe a general model of motivation
2. identify appropriate strategies to meet the motivational needs of a particular group.

a model of motivation

Motivation is a complex concept which incorporates several components: the motives and values which energize and direct behavior, the effort expended in achieving goals, the expectation the individual has that his effort and ability will result in successful task performance, and the expectation that successful task performance will lead to the desired reward. We have already looked at the types of goals that motivate behavior; now we will examine how individuals select goals and determine courses of action appropriate for achieving them. We can identify several characteristics of motivation by examining each component of motivation separately and in interactions with each other, as the motivation model below indicates:



Briefly, the model describes relationships among the various components of motivation. An individual's particular set of motives and values determine the amount of effort that an individual is willing to exert to reach a particular goal or reward. A sufficient amount of effort and ability, in combination, results in successful task performance. Success at the task generates the reward; in turn, attainment of the reward, or lack of attainment modifies the individual's set of motives and values. Given this general model, we can now examine each component in greater detail.



sources influencing motives and values

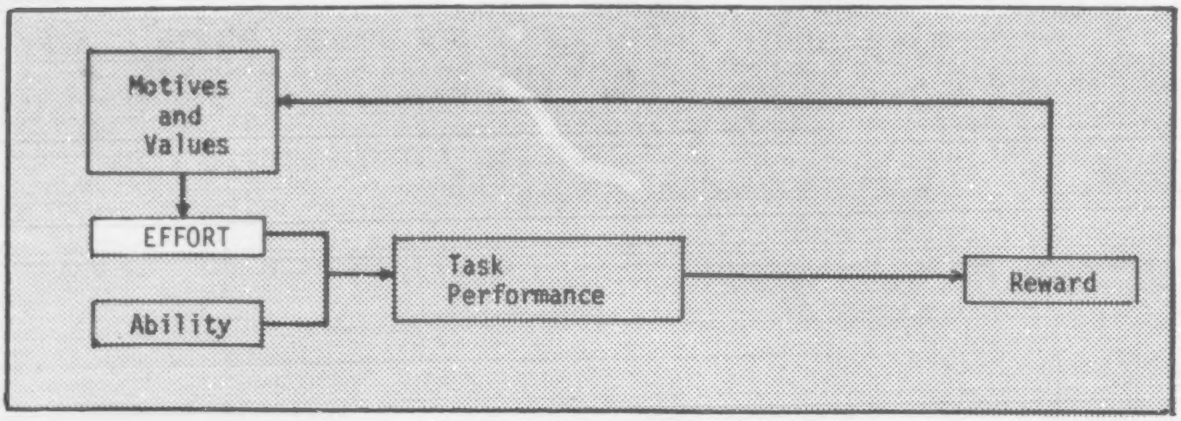
We behave in certain ways because we have certain values, set particular goals, and strive to meet certain needs. Each of us carries within ourselves a set of values, motives, and needs that informs our personalities. These values and motives are a product of both our culture and our personal choices. They are a part of our determination of what we will do or not do, in terms of our occupations, our leisure activities, even the friends we choose and the type of family life we have.

motives and values influence rewards

This set of motives and values directly influences the kinds of rewards we seek. An individual who values money will seek employment that pays well and a lifestyle that represents financial well-being overtly; he may buy a large home, a luxury car, perhaps even a boat; he may spend vacations traveling abroad; he may even choose to spend large amounts on expensive clothing. Another man who values personal freedom will choose employment that pays less well but allows him a great deal of liberty; he will choose a smaller home and car, take less expensive vacations, and spend less money in general; but he will have more free time to spend as he chooses and more control over how and when he does his work. There is a direct relationship between one's set of values and motives and the rewards that the individual is willing to work for.

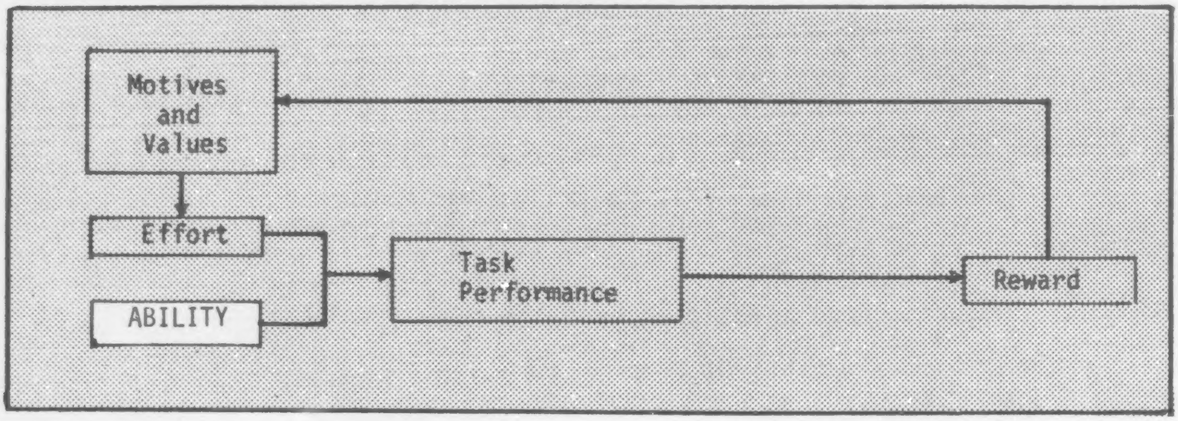
motives and values influence choice of tasks

Also linked to our set of values and motives are decisions about the kinds of tasks we are willing to perform to achieve our goals. A woman who values her role as homemaker and mother will not willingly seek employment outside her home. Another may believe that her fulfillment lies primarily in the practice of her profession; she will eagerly seek outside employment, perhaps even hiring another woman to care for her home and children while she works. Several individuals who seek praise will perform different tasks in order to earn that praise. One may become a gourmet cook, another a sculptor, and the third seek recognition through his/her job. We all identify certain tasks as important and appropriate for ourselves and reject others as inappropriate or improper. Thus each of us acts on our set of motives and values by selecting certain rewards and tasks as meaningful and relevant for our own lifestyle.



effort Our motives and values also influence the amount of effort--time and energy--we are willing to expend toward earning rewards. Effort is compounded of three interwoven components: the amount of time and energy required to complete a given task, the expectation that expending such effort will result in task completion, and the belief that task completion will lead to the desired reward.

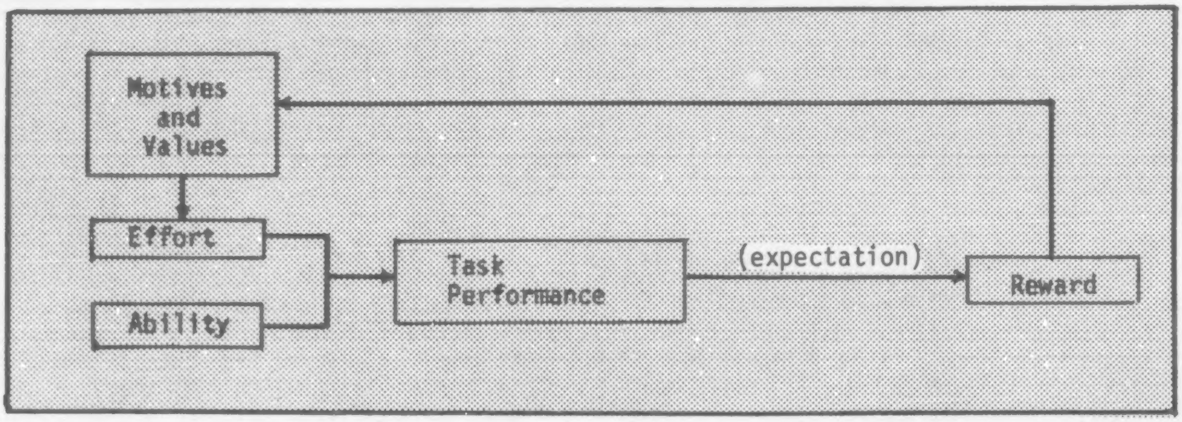
How much effort is required? Is the reward worth that much effort? We have to deal with many needs and goals and we have only a finite amount of time and energy available for striving toward them. Thus we must make choices. The desire to spend more time with your family and the need for a new living room couch may compete for your time and energy. You would like to be able to have both, but you must choose between working overtime to pay for the couch and spending that time with your family. Each goal has value--which has greater value for you?



ability

Can you perform the tasks required to achieve your goal? Ability is an important component of effort. No matter how much effort you are willing to expend, if you lack the skills and knowledge necessary to perform the tasks, you will be unable to achieve your goal.

Will the right combination of effort and ability actually result in successful task performance? In some circumstances, no amount of effort and ability is successful. In games of chance, the probability of success has little or no relationship to effort or ability. Similarly, when environmental constraints exist, such as poor organizational management, inefficient supply routes, or lack of communication, effort is wasted and ability is meaningless.



expectation

Will successful task performance actually lead to the desired reward? What guarantee is there that you will receive your desired reward if you perform the tasks? An employee who works long and hard in order to receive a promotion may not receive it; instead, his/her supervisor will simply expect the employee to continue his/her high level of diligence and competence. The supervisor see successful job performance as a requirement for keeping the job, not as grounds for promotion. Thus the reward is not forthcoming. The less one perceives a relationship between successful task performance and rewards, the less likely that person is to be motivated to continue performing well. Thus, people need to see overtly the relationship between performance and reward; without guarantees that success will be recognized in ways that are relevant to the individual, s/he will cease to strive after success.

Thus, we can say that the motives and values an individual possesses cause him to choose particular tasks and rewards on which he is willing to expend time and energy. If he perceives that the chosen goal is worth working for, that he is capable of achieving the desired reward through a combination of effort and ability, and that there is a direct relationship among effort and ability, successful task completion, and the desired reward, then the individual will be motivated to strive toward the reward. If one or more of these components is missing, motivation will be reduced accordingly.

motives and values change

Two additional points must be made. First, the relationship we perceive among the components of motivation changes as we gain experience and insight. If our experience leads us to believe that our efforts rarely produce the rewards we desire, we cease to expend much effort. If, on the other hand, experience teaches us that diligence and hard work lead to desired rewards, we will increase our effort. Thus, previous experiences and insights modify and structure our perceptions of the relationships among effort, performance, and reward and lead to modifications in our value system.

we can increase ability

Second, ability and effort are often within our control. We choose the amount of effort we are willing to expend in each of several activities. Equally, we can choose to expend effort to develop our abilities. Often, we believe a goal to be so worthwhile that we will expend effort in learning how to perform the tasks necessary to accomplish it. For this reason, people go to colleges and trade schools; thus, ability is not totally constrained. However, our efforts to educate ourselves and thus increase our abilities require significant expenditures of time and energy; we must also be capable of delaying desired rewards, often for several years, until we have developed the requisite abilities.

intrinsic rewards

Intrinsic and Extrinsic Rewards. A final concern is the distinction between intrinsic and extrinsic rewards. A reward is called intrinsic when the individual sees some task as meaningful, important, and enjoyable in and of itself. The satisfaction of the task becomes its own reward and ability to complete the task is reinforcing. For example, a young man may choose to spend all of his free time working on, repairing, and rebuilding cars. He derives pleasure from his work and satisfaction from seeing old, derelict vehicles restored and running. His friends bring their cars to him for repairs. He chooses this task for the enjoyment it brings him; he seeks no monetary or other external reward and never charges his friends for his labor. He has found an intrinsic reward, since the more he works on cars, the more he wants to work on them. Clergymen, medical personnel, social workers, and others in similar professions are motivated intrinsically; the salaries they receive are less rewarding than is the pleasure they receive from helping others.

extrinsic rewards

Extrinsic rewards utilize reinforcers that are external to the individual, such as money, grades, degrees, and job recognition. The individual strives for the external reward attached to a goal, rather than simply enjoying the task itself. The instructor or employer usually sets the rewards toward which trainees and employees strive; however, extrinsic rewards are dependent on the dispenser of the reward--the employer or instructor. If the reward-giver is out of the picture for any reason, there is no incentive to succeed. For example, a young woman may choose to work at a relatively boring job because of the high salary, good benefits, and rapid promotion opportunities. So long as she is regularly reinforced for her efforts with raises, bonuses, and promotions, she will continue to work fairly hard. However, as soon as the external rewards are removed, she will reduce her effort. She is controlled by the nature of the extrinsic rewards; without them, she has no reason to exert herself.

Extrinsic rewards have less strength and less long-term power than do intrinsic rewards. The knowledgable instructor or employer, therefore, learns what goals are important to trainees or employees and structures a motivational system that uses a minimum of extrinsic rewards. In fact, opportunity for fresh and novel experiences is, in itself, a good intrinsic reward, as is the chance to earn praise from peers. Grades are far less useful in the long run.

An understanding of these characteristics of motivation is important for trainers, who must both motivate trainees and help them to become self-motivating. It is especially important to help trainees set realistic goals so that they will expect to achieve them. A balance must be struck so that successful task performance is neither too easy nor too difficult to achieve. Rewards must be meaningful, appropriate, and obtainable; trainees should be involved in the selection of tasks and rewards. An employee who is not interested in job enlargement or promotion is an unlikely candidate for a training program to expand his skills; he should be able to choose whether or not he wishes to participate in the program.

Further, every effort should be made to identify intrinsic rewards for each employee and trainee. Such rewards as the opportunity to work on a new and exciting project, the chance to help plan a training program that will be more responsive to employees' needs, provision for time to spend on personal, job-related interests, and other similar rewarding activities will energize and direct worker attention and effort and result in more satisfied personnel.

Finally, motivation should be established through positive reinforcers, both intrinsic and extrinsic, rather than through threats and punishments. Assuring opportunities for meeting social needs through group membership and identification, providing opportunities for success and for recognition by peers and superiors will help to foster more attractive working and learning environments. Care must be taken to ensure that trainees' goals and program goals are coordinated. Instructors must become aware of the needs, values, and interests that motivate trainees.

GUIDELINES FOR MOTIVATING TRAINEES

1. Know your trainees. Find out why they are in training programs, what they expect and need from their jobs, and what their needs and values are. An initial training session that focuses on the trainees rather than on the topics of training will help you to make training more relevant to the trainees.

2. Construct a system of rewards that is relevant to the trainees. Do not use grades unless the individual has a need to be graded. Pass/not-yet-pass systems can be equally effective for management's purposes and will not involve trainees needlessly in competing for grades.

3. Make sure that trainees know why they are undergoing training. Determine how they feel about the reasons for training. A need to improve skills that is felt strongly by a trainee provides a very different motivation than is felt by someone who is simply doing what his supervisor told him to do.

4. Make training realistic. Build in guarantees of success so that trainees will believe that they have the pre-requisite skills and knowledge to succeed during training. Make success attainable but not too easy. Know how much time and energy trainees will have to exert to succeed; do not require more than they are willing and able to give. Remember that they have lives outside the work environment that also require time and energy.

5. Ensure that trainees believe that successful performance will result in the desired or promised reward. Don't promise what you can't deliver. Work with trainees, supervisors, and management to build a system of realistic and meaningful rewards. Publicize the system and the standards for earning the rewards so that trainees know what is possible and how to attain it.

6. Help trainees to develop intrinsic reward structures. Find out how their jobs can be made more personally satisfying; work with them to achieve personal satisfaction. Work within the organization to build a system of intrinsic activities such as peer recognition programs, recreational activities, career ladders, and the like, through which employees can achieve a sense of personal commitment to and satisfaction from the organization.

7. Praise is a very strong reinforcer; however, when it only comes from above--from a trainer or supervisor--it remains an extrinsic reward. Create opportunities for providing praise from peers and from the trainee or employee him/herself; help the trainee to recognize and be proud of work that is well done.

8. The organization as a whole must ensure that needs on the first two levels of Maslow's hierarchy--physiological and safety needs--are met before it can turn attention to those needs higher on the hierarchy.

9. To help identify motivational and environmental problems, use the Problem Definition Worksheet (see Unit Two: Analysis). Plan your problem-solving strategy in terms of what you learn from using the Worksheet. If the problem is motivational, work to improve the reward structure; if the problem is environmental, work to remove inhibiting or constraining factors.

SELF-CHECK #3

1. What are three sources which influence a person's motives and values?

2. What factors determine how much effort we will expend on a goal?

3. How are motives and values, effort, ability, and task performance related to motivation? You may use either a diagram or a paragraph or both to explain.

4. What is an intrinsic reward? Why is an intrinsic reward preferrable to an extrinsic reward?

5. What are some intrinsic rewards that are relevant to you? Name at least two or three.

ASSIGNMENT 7.3

Answer Key

The following answers are suggested as acceptable responses to the questions in the Self-checks; your answers should be similar to the ones suggested.

SELF-CHECK #1

1. Motivation is some sort of personality factor that results in persistent, energetic, goal-directed behavior.

2. We measure the results of motivation rather than motivation itself. Some measurable components are
   a. type of goal
   b. importance or value of the goal (as compared to other goals)
   c. amount of effort expended toward the goal (time on task is a good indicator)
   d. persistence
   e. types of goal-oriented behaviors and actions.

SELF-CHECK #2

1. Maslow's structure is a hierarchy. The hierarchy requires that lower order needs be satisfied before higher ones can be dealt with.

2. 4 a) 2 b) 1 c) 3 d) 2 e) 5 f) 3 g)

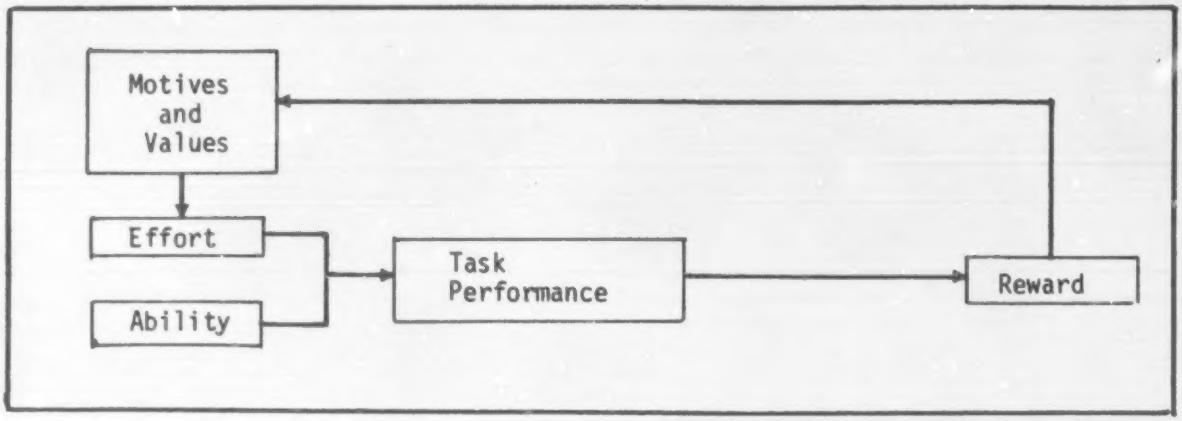
SELF-CHECK #3

1. Our values and needs come primarily from three sources: our sense of survival, innate in every animal, which drives us toward food, water, sleep, and sex; the values inherent in our culture, which we learn at a very early age; and the personal choices we make as a result of our individual personalities.

2. The factors determining how much effort we will expend on a goal are
   a. our analysis of the amount of effort necessary to attain the goal
   b. our analysis of the value of attaining that goal
   c. our belief that we have the ability--the skills and knowledge--to attain the goal
   d. our belief that successful task performance will result in the desired reward.

3. Motives and values determine what goals individuals pursue, and the types of tasks they are willing to perform to attain the goal. Effort is a measure of how much time and energy an individual is willing to

expend on attaining a goal; thus it is a measure of the worth of the goal to the individual. Ability determines how much effort one is willing to expend, since it helps to determine how successful the person will be in achieving the goal. A diagram of the relationship looks like this:



4. Intrinsic rewards involve reinforcers that are internal to an individual and which do not depend upon rewards provided by outside sources. In intrinsic motivation, satisfaction with some task is rewarding; the task is seen as meaningful, important, and enjoyable in and of itself.

Extrinsic rewards depend upon the presence of a reward-giver; when that individual is absent, motivation decreases. Thus intrinsic motivators, which are part of an individual, are always preferrable to extrinsic ones since intrinsic motivators do not depend on anyone else.

EXERCISE DESCRIPTION

You are a member of a training program; this is your first session. You have just met the other participants over coffee and now you are ready to discuss the nature and purpose of the training program, your goals as a participant, and your responsibilities to the program. Your task over the next 20 minutes is to identify a motivational system that will make you feel willing and eager to participate in the training. You should discuss with your fellow participants the types of extrinsic reinforcers that you believe will be useful and meaningful for this week-long program and you should also identify those intrinsic aspects that would motivate you regardless of the extrinsic reward system. You should be realistic in your determination of rewards, but not restrictive. You should, at the end of 20 minutes, have an outline of a motivational system that your group believes will be effective for the particular circumstances of your training program. Take notes in the space below; when the discussion ends, you should have recorded an outline of an effective motivational system.

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
LESSON 5 of 6: STRATEGIES FOR ENHANCING CONTENT

ASSIGNMENT 7.4: STRATEGIES FOR ENHANCING CONTENT

Estimated time: Sixty minutes

This assignment is concerned with strategies for enhancing content through devices to emphasize, highlight, illustrate, clarify, and otherwise illuminate important information. The readings introduce essential concepts and provide rules for enhancing content. Accompanying self-checks and exercises allow you to demonstrate your understanding of the content of this lesson. Answers to the self-checks are in the answer key at the end of the assignment. Some questions may not have a single correct answer; rather a range of answers may be appropriate. In the answer key, you will find a suggested or representative answer; your answer should be similar to the one suggested. If you feel that your responses are greatly different from those provided in the answer key, you may wish to consult your instructor.

OBJECTIVE: By the conclusion of this assignment, you will be able to identify instructional situations which warrant the use of each content enhancement strategy.

EVALUATION: Self-checks within the assignment will help you to evaluate your understanding of concepts for enhancing content.

DIRECTIONS:

1. Complete Reading #1: Enhancing Content. Answer the questions in Self-Check #1. This task should take approximately 5 minutes.
2. Complete Reading #2: Strategies for Highlighting Content. Answer the questions in Self-Check #2. This task should take approximately 15 minutes.
3. Complete Reading #3: Learning Guides. Answer the questions in Self-Check #3. This task should take approximately 10 minutes.
4. Read Rules for Enhancing Content and apply the rules in the application exercise. This task should take approximately 30 minutes.
5. Participate in a discussion on ways of making content more effective through the use of content enhancement strategies.

READING #1: ENHANCING CONTENT

This reading describes the nature of content enhancement strategies and explains why such strategies are important. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:
1. explain the purpose of content enhancing strategies
2. name at least three kinds of content enhancement strategies.

purpose

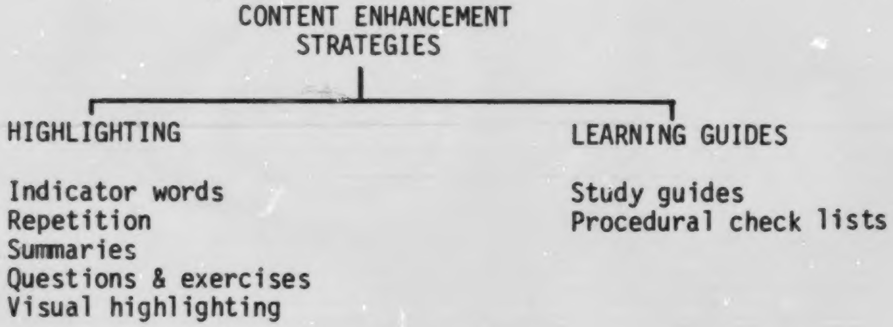
A content enhancement strategy is any device used to clarify, emphasize, illustrate, or otherwise illuminate the content of instruction. These strategies assist the instructor in pointing out important sequences of information, in identifying major concepts and principles, in providing additional means of explaining, and in making sure, generally, that learners understand what they are being taught. Whether it is used by instructor or learner, a content enhancement strategy is anything that makes the content of instruction more understandable and coherent for the learner.

form vs. function

It is important to distinguish here between the function such a strategy has and the forms it may take. Strategies may take the form of notes on a chalkboard, pictures presented as a series of slides, a film, or a typed handout. Thus, media are the forms strategies can take. However, regardless of its form, each strategy has a distinct function to perform: it enhances content by emphasizing, clarifying, illustrating or otherwise illuminating the content of instruction. Using these strategies will make learning and teaching easier.

This training program makes extensive use of content enhancement strategies in a variety of forms. Figures clarify and illustrate concepts; content outlines and handouts emphasize and clarify important points and indicate sequences; exercises and self-checks highlight important content. As you can see, regardless of their forms, content enhancement strategies always function to make learning more effective and efficient. This lesson focuses on the functions of such strategies; Unit Six, Selecting Media for Instruction, provides instruction in selecting effective forms.

Content enhancement strategies can be divided roughly into two major groups: highlighting techniques (which include techniques for pointing out important concepts, identifying sequences, illustrating, and providing alternate means of explaining content) and learning guides (which direct learners through lengthy or complicated procedures and lessons). Between the two groups there is some overlap; we can, however, distinguish between them on the basis of the function each type of technique fulfills. A simple diagram of these two groups may increase your understanding of them (see Figure 1).


CONTENT ENHANCEMENT STRATEGIES

HIGHLIGHTING
- Indicator words
- Repetition
- Summaries
- Questions & exercises
- Visual highlighting

LEARNING GUIDES
- Study guides
- Procedural check lists

Figure 1

In this lesson, we will examine each group and identify the particular uses, strengths, and limitations of each type of technique. We will also look at some general guidelines for using content enhancement strategies. Finally, you will have an opportunity to practice creating strategies for enhancing content within a lesson.

SELF-CHECK #1

1. What is a content enhancement technique? Why are these techniques used?

2. Is a film automatically a content enhancement technique? Why or why not?

3. A content enhancement technique can be identified in terms of its ___.
   a) form
   b) function
   c) form and function

4. Briefly describe one technique that you found particularly useful during your studies in this workshop. What function(s) did it perform? What form did it take?

READING #2: TECHNIQUES FOR HIGHLIGHTING CONTENT

This reading presents several techniques for highlighting content through emphasis, illustration, identifying sequences, and providing alternative means of explaining and exemplifying. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. name and identify an example of a least five highlighting techniques
2. describe a strategy for providing highlighting during an oral presentation such as a lecture.

The use of various devices to emphasize, illustrate, and illuminate particular parts of instructional content is called highlighting. Highlighting can occur verbally or visually; it can utilize oral and written presentations. It involves overtly calling to learners' attention some parts of the content to be learned. Highlighting techniques include the use of indicator words (such as "first", "remember that", and "as a result") to identify sequences, important relationships, and crucial concepts and principles; the use of repetition and illustrations to clarify and exemplify; the use of summaries, questions, and exercises to emphasize and isolate important points; and the use of visual techniques to emphasize, clarify and isolate content. We will examine each type of technique in turn.

1. Indicator words. Indicator words are words that identify the order of information, emphasize important concepts and principles, identify relationships, and indicate changes of topic and direction. A list of important indicator words is included below (Figure 2); you should make a conscious effort to use them during instruction. Indicator words are especially important during oral presentations such as lectures since these words guide learners through the presentation, point out sequences and relationships, and key learners that important topics and changes of direction are coming.

2. Repetition. Repetition is another important highlighting technique; it serves to draw learners' attention, to emphasize the importance of ideas, and to deter forgetting. Repetition should involve both the use of repeating of the important information itself and the use of overt attention-drawers such as "Remember the formula for . . ." or "We were talking about this concept earlier . . .". The repetition can occur in one of two forms; you can repeat the idea exactly as you said it earlier

INDICATOR WORDS

Words Indicating Order

First
Second
Third, etc.
Next
Prior to
After, afterwards
Later
Earlier

Words Indicating Similarity Among Ideas

Like, as
Equally
Similarly
Also
Moreover
Further
In addition
In the same vein

Words Indicating Differences Among Ideas

However
But
On the other hand
In opposition
On the contrary

Words Indicating Importance

Notice (that)
Remember (that)
Watch for

Words Indicating Conclusion or Result

Finally
In conclusion
As a result
In summary, to summarize
In sum

Figure 2

or you can find another way to express it. The use of alternate means of expressing ideas helps learners to understand the ideas more easily. Unless a specific definition or rule must be remembered and used verbatim, it is always better to find an alternate way to express it.

3. Summaries. Providing a brief summary of important lesson content is another important highlighting technique. At the end of a logical unit of content (which may be only part of a lesson), the instructor should provide a brief summary of the main points presented; the instructor may briefly review the content or may call on a learner to provide the review. Additional highlighting effect can be obtained by writing a brief outline of the summary on the chalkboard or overhead transparency. The summary should identify the major points of the lesson, in order, with important definitions, concepts, and principles included. Examples, illustrations, and alternate means of expressing ideas should not be included in the summary.

4. Questions and Exercises. A highlighting device that is particularly useful is the insertion of questions and exercises into a presentation. The questions and exercises serve two important purposes. First, they provide learners with needed practice in manipulating ideas and skills. Second, this technique provides a variation of repetition by requiring learners to repeat important information in order to answer questions and complete exercises. Learners can be asked to respond orally or in writing; when responses are to be written, an answer key should be provided so that responses can be evaluated. Questions and exercises should be designed to help learners practice the types of responses they will be required to make during evaluations and on-the-job. If learners must eventually apply a formula, then questions and exercises should lead up to and include exercises in application. If questions and exercises are given and responded to orally, the instructor should ask the question first and then call on a participant; this technique requires all learners to think about a response rather than waiting until their turn arrives. Questions and exercises should occur frequently during initial stages of learning since responses will be more uncertain at this point; each question or exercise should require a small bit of information. As more sophistication with content develops, responses may become more general and larger. Application exercises should be preceded by comprehension questions and exercises so that learners can demonstrate their understanding of ideas before they are required to apply the ideas.

5. Visual Highlighting. Visual highlighting can be obtained in several ways; the most obvious are the use of pictures and dia-

grams for illustration and the use of page layout for clarification, isolation, and emphasis.

pictures

Pictures provide an attractive complement to instructional content when they are properly used. Pictures should never be provided merely to entertain or to fill a page; they must always serve a specific purpose. When properly used, pictures can illustrate important concepts, demonstrate skills, and clarify ideas that are difficult to explain verbally. Color is not an important consideration, since research has indicated that simple black-and-white line drawings are highly effective. Pictures should be used sparingly.

graphs and charts

Graphs and diagrams serve to illustrate concepts and procedures, to provide alternate means of expressing ideas, to indicate sequences and relationships, and to clarify ideas that are difficult to express verbally. Graphs and diagrams should be clear and uncluttered, properly labelled, and as simple as possible. They, too, are not present for entertainment, but must serve a specific purpose. A diagram can serve to identify the sequence of steps in a complex procedure; a graph can demonstrate a relationship among important variables. Graphs and diagrams can be used whenever complex numerical or spatial information must be presented.

page layout

Page layout involves the arrangement on a page of words and symbols such as pictures, diagrams, color, and arrows. Textbooks make wide use of effective page layout techniques by changing typeface, indenting, leaving large amounts of white space around key points, and using color, underlining, arrows, and italics. Large type indicates titles and main headings; underlining or italics emphasize main ideas; color and arrows draw attention to specific topics. Even with home-made instructional materials, multiple type-faces and underlining, arrows, and italics can be used effectively to emphasize, isolate, clarify, and integrate important content. However, it is important to remember that visual highlighting techniques are not used to entertain; they must fulfill specific functions.

Highlighting is a most effective means of calling learners' attention to important concepts, identifying sequences and relationships among ideas, providing emphasis, and illustrating content. It can be used for both oral and written presentations and can be created by both instructor and learners. An effective content presentation always includes a judicious combination of the various highlighting techniques.

SELF-CHECK #2

1. What is highlighting?

2. How can highlighting be achieved? Name at least three ways.

3. What are indicator words? How are they used?

4. Who should provide a summary? What should it contain?

5. How can questions and exercises function as highlighting?

6. When and how should pictures, graphs, and diagrams be used? Give an example of the way in which you might use a visual during a lesson on a topic relevant to your training situation.

READING #3: LEARNING GUIDES

This reading introduces two kinds of learning guides, study guides and procedural check lists. A brief self-check follows the reading.

By the conclusion of this reading, you should be able to:

1. describe the contents and purpose of a study guide and a procedural check list.

A second major category of content enhancement techniques is the learning guide. The guide directs a learner through a piece of instruction; it is thus designed for use by the learner. It may tell the learner how to use the instructional materials, direct the learner through a sequence of activities, or serve as a check list to ensure correct performance of a sequence of steps or tasks. There are two basic types of learning guides: study guides and procedural check lists.

Study Guides. A study guide is a set of directions to the learner for proceding through a unit, a lesson, or a single activity. At the unit or lesson level, the guide should include a statement of the objectives, a description of evaluation activities, and directions for completing them, and the time that should be allotted to each activity. At the activity level, the guide should briefly list the contents of the activity, the evaluation, and the objective. This assignment has an introductory study guide; each separate activity, which contains a reading and self-check, has its own study guide. Moreover, this unit was introduced, in your manual, by a study guide which identified the purpose, objectives, and contents of the unit and provided you with a summary of the important information within the unit. A study guide serves the same purpose for the learner that an Instructional Package Worksheet (IPW) does for the instructor; it identifies the sequence of activities through which learners must proceed, the goal and purpose of the instruction, and the things learners and instructor must do as they proceed through the instruction.

Study guides vary in detail depending upon the length and complexity of the activities, the degree of instructor-involvement in the activities, and the types of activities. A very simple study guide, such as might be developed to accompany an exercise, may contain only a brief description of the exercise and a sentence or two of instructions; this type is most useful when the instructor is in charge and present during the exercise to assist learners and answer questions. A more complicated assignment that does not involve instructor control may require a more detailed and complex study guide. An individualized instructional unit designed to be taken home by the learner may contain several pages of instructions and directions since the learner will not have an instructor available to assist him. The nature of its intended use determines how long and complex the study guide must be. However, regardless of its intended use, the study guide for a unit or lesson of instruction must contain at least the following information:

1. a brief description of the contents and purpose of the instruction, along with the conditions of its use
2. a statement of the objective(s)
3. a description of the evaluation activity(s)
4. directions to the learner on how to proceed through the activities, with indications of the time each activity should be allotted.

For examples of study guides for a unit, a lesson, and an activity, refer back to the appropriate pages for this unit in your manual.

Procedural Check Lists. A procedural check list is a document used to guide an individual through the sequence of steps and activities contained within a procedure. It contains a listing of all the steps and subtasks involved in the procedure, together with a list of necessary equipment and materials, descriptions of special facilities, and warnings, special notes, and concerns and constraints. It can be a simple verbal list, a diagram, or a combination of the two. Procedural check lists are used both to teach new procedures and as support for complex or infrequently performed procedures. Primary characteristics of any procedural check list are

1. a description of any special resources required to carry out the procedure
2. a sequential listing or diagram of all steps to be performed
3. a place to check off each step as it is carried out, with space for comments
4. brief notations of warnings, constraints, and special considerations (as appropriate).

Figure 1 and 2 contain examples of procedural check lists.

Procedural Check List

Safety Procedures: Screening and Grinding Operations

The goal of safety is the continuous and efficient operation of unit without loss of health or comfort to the operator and loss of efficiency of unit.

Step/Task Completed	Step Sequence	Information/Operating Goals/ Specifications	Comments
	1. Inspect walkways	1. Walkways and steps should be clean, free of obstructions, not slippery with oil, grease, ice, etc.	
	2. Inspect ladders and steps.	2. Ladders should have separate handrails and, if over 10 feet high, have safety cage.	
	3. Check safety signs.	3. Entrance to structure should have sign, warning: Open pit and moving equipment.	
	4. Check washdown hoses.	4. Washdown hoses should have racks and areas to drain.	
	5. Check hand tools storage area.	5a. Hand tools should have storage area. 5b. A list of tools on hand should be kept for replacement lists.	
	6. Check debris container.	6. Manually removed debris should have separate container with tightly fitting lid.	
	7. Check electric controls.	7a. Electric controls should have locks with keys.	
	8. Check guards and protective shields.		
	9. Check safety switch on grinder door.		
	10. Check safety equipment.		

Figure 1

PROCEDURAL CHECK LIST FOR WORKSHOP PLANNING AND PREPARATION

Comments and Notes	Step/Task Completed	Time in Weeks Prior to Workshop Delivery	Activity
	____	Ten	Obtain complete copies of Staff Guide and Participant Reference Manual and review thoroughly.
	____	Nine	Design workshop schedule, select dates and times, secure classroom/meeting space.
	____	Eight	Announce workshop or otherwise establish procedures for determining the participants.
	____	Seven	Check physical requirements for conducting workshop and make necessary arrangements, place orders, etc. -seating -water, coffee -ventilation, heat, light -overhead projector, screen -chalkboard or easel -other audio-visual equipment for Unit Six -Xerox and Thermofax equipment -paper, pencils, etc.
	____	Six	Prepare to conduct workshop by thoroughly reviewing IPWs, Content Outlines, etc. Review the materials under "References" for additional help in unfamiliar areas.
	____	Five	Obtain list of intended participants and send letter with Pre-Workshop Survey.
	____	Four	Prepare the necessary copies of all instructional materials -Handouts -Participant Reference Manuals -Overhead transparencies
	____	Three	Analyze Pre-Workshop Survey
	____	Two	Prepare final notes for delivering each lesson. Determine the points to emphasize, examples to use, etc.
		---	Begin workshop.

Figure 2

ASSIGNMENT 7.4

Answer Key

Below are suggested answers to the self-checks. Your responses should be similar to the ones suggested.

SELF-CHECK #1

1. any device used to clarify, emphasize, illustrate, isolate, or otherwise illuminate important information within instruction
2. no; a film is only a content enhancement technique if it fulfills one or more of the functions of clarification, emphasis, illustration, or isolation
3. b

SELF-CHECK #2

1. highlighting is the use of various devices to illuminate important bits of information during instruction
2. repetition
   summaries
   indicator words
   questions and exercises
   visual highlighting (page layout, illustrations, color, arrows, typeface, or underlining)
3. words which point out sequences, relationships, results, or important concepts
4. either the instructor or a trainee can provide a summary; it should contain a listing, in order, of the important ideas of the lesson
5. they provide both repetition and practice
6. visuals should be used only to illustrate, clarify, or emphasize; they should never be included merely to entertain or beautify

UNIT SEVEN: SELECTING INSTRUCTIONAL STRATEGIES
LESSON 6 of 6: TEACHING TOWARD THE OBJECTIVE

ASSIGNMENT 7.5

Estimated time: Two hours fifteen minutes

This assignment is concerned with strategies for teaching each type and level of behavior. The readings and self-checks introduce concepts and strategies relevant for each separate type of objective--Cognitive, Psychomotor, and Affective--and for each level of Cognitive Behavior--knowledge, comprehension, application, and problem-solving. Answers to the self-checks are in the answer key at the end of the lesson materials. Some questions may not have a single correct answer; rather, a range of answers may be appropriate. In the answer key, you will find a suggested or representative answer; your answer should be similar to the one suggested. If you feel that your responses are greatly different from those suggested in the answer key, you may wish to consult your instructor.

OBJECTIVE: By the conclusion of this assignment, you will be able to select instructional strategy components that are appropriate for each type and level of behavior specified in an objective.

EVALUATION: Self-checks within the assignment will help you to evaluate your understanding of concepts of teaching toward the objective.

DIRECTIONS:
1. Complete Reading #1: Cognition and Cognitive Objectives. Answer the questions in Self-Check #1. This task should take approximately 10 minutes.
2. Complete Reading #2: Teaching Knowledge-Level Objectives. Answer the questions in Self-Check #2. This task should take approximately 10 minutes.
3. Complete Reading #3: Teaching Comprehension-Level Objectives. Answer the questions in Self-Check #3. This task should take approximately 20 minutes.
4. Complete Reading #4: Teaching Application-Level Objectives. Answer the questions in Self-Check #4. This task should take approximately 15 minutes.
5. Complete Reading #5: Teaching Problem-Solving Objectives. Answer the questions in Self-Check #5. This task should take approximately 15 minutes.
6. Complete Reading #6: Teaching Psychomotor Objectives. Answer the questions in Self-Check #6. This task should take approximately 10 minutes.

7. Complete Reading #7: Teaching Affective Objectives. Answer the questions in Self-Check #7. This task should take approximately 10 minutes.
8. Participate in the final exercise.

READING #1: COGNITION AND COGNITIVE OBJECTIVES

This reading introduces you to the concept of cognition and identifies the hierarchy of four levels of cognitive skills. A self-check follows the reading. By the conclusion of this reading, you should be able to:

1. define cognition and give an example of a cognitive skill
2. identify the name, characteristics, and types of skills associated with each level of cognitive behavior.

cognition

Cognition refers to the processes of knowing, thinking, remembering, and other intellectual activities. Cognitive skills include the ability to state facts, classify objects and events, explain ideas, use rules, follow procedures, and solve problems. When we learn and remember a phone number, or solve an equation, or follow a set of directions, we are using cognitive skills.

a hierarchy of cognitive skills

There are several different levels of cognitive skills, which exist in a hierarchy. That is, they exist in a sequence such that lower-order skills are an important part of higher-order skills. Lower-order skills must be learned before higher-order skills can be learned. Also, skills and knowledge acquired at a lower level are necessary for learning at higher levels. There are four levels of cognitive skills in the hierarchy.

knowledge: naming, stating, listing and labeling

At the lowest level is knowledge, the set of skills reflecting the ability to recognize or recall information: to state, name, list or label. A trainee knows a chemical formula when he can state the formula whenever he is requested to do so. Notice that no understanding is implied--merely the ability to state the formula.

comprehension: explaining and classifying

At the next level is the set of skills called comprehension, which reflect the ability to explain or classify information. When a trainee can explain what the formula means, he comprehends it.

application: using rules and following procedures

At the third level are application skills, which reflect the ability to use information to solve equations, use rules and formulae, and follow procedures. At this level, the trainee can use a formula to carry out a test or follow a procedure to perform a task.

problem-solving: generating new rules and procedures

The highest level of skills is problem-solving, the ability to discover or generate "new" rules and procedures--that is, rules and procedures which are new to the trainee, although not necessarily original or novel to an expert in the field. The trainee who can use what she has previously learned to create a novel solution to a problem--a solution that she has not been taught--is demonstrating problem-solving skills.

It is important to remember that these levels of cognitive skills exist in a hierarchy. Lower-level skills must be learned before higher ones can be learned because the lower-level skills generate knowledge and skills which are needed in order to develop higher-order skills. Thus each level of skills serves as a building block for skills at higher levels. This relationship can be displayed visually:

PROBLEM SOLVING SKILLS
Ability to generate new rules and procedures

require as prerequisites

APPLICATION SKILLS
Ability to use rules and follow procedures

require as prerequisites

COMPREHENSION SKILLS
Ability to explain and classify

require as prerequisites

KNOWLEDGE SKILLS
Ability to state, name, list and label

Within this hierarchical arrangement of skills, each of the four levels differs from the others in several important ways. Each has a different kind of content on which the skills are practiced. Each level results in different kinds of learning and produces different kinds of observable behaviors. Each level also requires different kinds of instructional strategies.

In this lesson, we will examine each level of cognitive skills, identify the content on which the skills are practiced, examine the kinds of behaviors (skills) that result from learning at that level, and describe a set of instructional strategies for teaching that level of cognitive skills. We'll begin with the lowest level of cognitive skills, knowledge.

SELF-CHECK #1

1. Identify each example of a cognitive skill from the list below by putting a "C" next to each correct example.

____ a) Barry is only two years old but already he can print his name.

____ b) The training session for today taught us how to perform the suspended solids test.

____ c) My son learned to calculate the mean of a sample of test scores.

____ d) Elizabeth is learning to be more tolerant of her younger brother.

____ e) The mechanic solved the ignition problem on my car.

2. Each of the four levels of cognitive skills is listed below. For each, name a representative skill or ability.

Knowledge: ____________________

Comprehension: ____________________

Application: ____________________

Problem-Solving: ____________________

3. What does the term cognition mean? Write a definition in your own words.

READING #2: TEACHING KNOWLEDGE-LEVEL OBJECTIVES

This reading introduces knowledge-level cognitive skills; it defines the concept knowledge, describes the characteristics of knowledge-level learning and teaching, and identifies strategies for teaching at this level. A self-check follows the reading. By the conclusion of this reading, you should be able to:

1. explain what knowledge-level learning requires
2. identify the contents of knowledge-level learning
3. identify objectives written at knowledge level
4. list strategies for teaching knowledge-level objectives

knowledge: knowing that

recall or recognition

At the lowest level of cognitive skills is knowledge, which is the ability to name, state, list, or label. At this level, the individual knows that something is; she may be able to list, in order, the steps involved in performing the suspended solids test, but she will not be able to explain why or when the test should be performed or actually perform it. A knowledge-level skill results in the ability to recall or recognize information on demand; it does not imply any understanding of the information.

facts

The contents of this level of behavior are called facts. A fact is simply a single piece of information. A mathematical "fact" is "7 x 3 = 21". A history "fact" is "Americans celebrate their independence day on July 4". A chemical "fact" is "The symbol for iron is Fe". Facts make up a very large part of what every human knows; they are the essential building blocks of all understanding since facts carry information. Whenever we learn to put a name or symbol with an object, or to put a term with a definition, or to list the steps of a procedure, or state a formula, we are learning facts.

For example, a geometry student may be asked to know that the formula for finding the area of circle is "$A = \pi r^2$". She will know that formula when she can repeat it from memory or state it in answer to the question "What is the formula for finding the area of a circle?" Note that the student is not able to explain the formula or use it to find the area of a particular circle. These types of behavior are at higher levels than knowledge. Knowledge of a fact means that one can state the fact, not explain it or use it in any way.

ability to:
state
name
list
label

Any piece of information can be learned as a fact. Factual learning--knowledge--merely involves the ability to state, name, list, or label something. An instructional objective at the knowledge level may require the learner to:

-state the symbol for an object or event
-name an object or its parts
-label a diagram or drawing
-name the functions, uses, or properties of an object
-state a definition, rule, or formula
-list, in order, the steps of a procedure
-list the details of an event

Factual learning requires heavy emphasis on memorization since trainees must be able to demonstrate recall or recognition of facts. There are two types of instructional strategies involved in teaching facts: organizational strategies, and practice strategies.

mnemonics

Organization strategies. Since human memory can deal with only a few (usually 5-9) separate bits of information at a time, knowledge-level learning must be highly organized in order to be efficient. Some especially useful organizational strategies involve the use of memory devices (often called mnemonics) such as acronyms and rhymes. Any memory device which organizes separate facts into related groups will help trainees to learn those facts more effectively and efficiently. For example, children who are learning the number of days in each month can be taught the following rhyme to help them organize the months into groups which all have the same number of days:

"Thirty days hath September, April, June, and November;
All the rest have thirty-one,
Except February alone,
Which has twenty-eight in fine,
And each leap year twenty-nine."

Any technique which helps trainees to organize information will assist them in remembering that information.

drill and
recitation

Practice Strategies. Practice is an essential component of fact learning since the facts must be repeatedly presented and practiced before they are learned. Drill and recitation are important strategies for providing practice. Trainees must have frequent practice in recalling and recognizing facts. Facts must be learned exactly as they are presented; paraphrase is usually not permitted at this level. Seeing or hearing the facts is not sufficient; trainees must have opportunities to practice stating, naming, listing, and labeling until they can perform the required behaviors on demand.

match practice to job performance

Practice must also be given in the form in which the facts will actually be used in assessments and on the job; if the desired behavior is ability to identify the parts of a piece of equipment, trainees must have practice in labeling the parts, perhaps on a drawing at first, but eventually on the piece of equipment. Merely requiring them to list the parts will not prepare them for the final desired skill.

multiple responses

Also, practice opportunities should require trainees to provide the desired information in a variety of ways. The more varied the kinds of practice experiences, the more effective and long-lasting the learning will be. Appropriate kinds of practice may include requiring trainees to state a definition when given a term, to label parts on a diagram, to match terms and definitions, or objects and functions, to rearrange scrambled procedures so that the steps are listed in the correct order, or to match symbols with the objects they represent. All practice and performance tasks at this knowledge level must require either recall or recognition of facts.

INSTRUCTIONAL STRATEGIES FOR KNOWLEDGE-LEVEL OBJECTIVES

1. Make certain that the objective requires knowledge-level behavior. Do not confuse knowledge-level requirements with requirements for higher skill levels.

2. Do not waste time requiring trainees to memorize facts that are readily accessible from print or other available sources. Require memorization only when it serves some useful and efficient end.

3. Present facts in an organized form. Remember that, in general, most people can remember only 5-9 separate bits of information at a time. Organized groups of facts can be remembered as easily as separate, unrelated facts.

4. Lectures and individual assignments are the appropriate instructional methods for teaching facts. Guided discussions and demonstrations are not useful for knowledge-level learning.

5. Provide practice frequently and in a variety of forms. Trainees must have opportunities to practice making the specific types of responses that will be required of them during assessment and on the job.

6. The more varied the types of practice experiences, the more firmly the facts will be learned. Appropriate practice and assessment experiences include requiring statements of facts in response to questions, completion statements where part of the fact (such as a name) is used as a prompt, matching activities, listing activities, labelling exercises, and simple recitation.

7. Practice should be spaced over several sessions to allow trainees more practice opportunities. Single, long practice sessions should be avoided.

8. Encourage and help trainees to create and use appropriate memory devices (mnemonics) to assist their recall.

9. Practice experiences should be appropriate for knowledge-level learning. It is frustrating to try to learn to state a formula and to use it at the same time. Separate instruction on different cognitive levels; concentrate on one level at a time.

10. Provide immediate feedback. For oral responses, either the instructor or fellow trainees can provide feedback. For written responses, provide answer keys so that trainees will know immediately if their responses are correct.

11. Provide only as much practice as trainees need to learn the facts. Nothing is more frustrating or more damaging to motivation than to be required to spend unnecessary time repeating activities that have already been mastered. Whenever possible, provide for individualization by allowing those trainees who have mastered the desired skills to move on to other assignments while others who need more practice have the opportunity to obtain it.

12. Require mastery of knowledge-level learning. That is, set a minimum acceptable level of performance (such as 12 of 15 parts of a diagram correctly labelled or 18 of 20 definitions correctly stated); require trainees to practice until they reach that level of proficiency and then give credit for attaining the objective. In factual learning, letter grades which identify who got the most right are inappropriate.

13. Provide refresher practice at widely spaced intervals for important facts that may be forgotten.

SELF-CHECK #2

1. What are the contents of knowledge-level skills?

2. Under what circumstances would each of the following be considered knowledge-level learning? (You should provide a single answer to this question regardless of the number of statements listed here.)

   a) The capitol of Pennsylvania is Harrisburg.

   b) The value of π is 3.1417.

   c) A binomial equation can be factored into two separate terms.

   d) Acidity is a condition in which there is a preponderance of acid materials in the water.

   e) $\overline{X} = \frac{\sum x}{n}$

3. How many separate pieces of information can human memory deal with at any one time?

4. What is a mnemonic? Give a brief example of a mnemonic you have used.

5. Which of the following objectives are not written at knowledge-level?

   The trainee will be able to:

   a) match each symbol on the flow chart to its appropriate explanation.

   b) label correctly the parts of the spectrophotometer.

   c) explain the reasons for performing the suspended solids test.

   d) list, in order, the steps involved in operating the pH meter.

   e) perform a pH test.

READING #3: TEACHING COMPREHENSION-LEVEL OBJECTIVES

This reading introduces the strategies involved in teaching comprehension-level objectives and discusses the reasons for each type of strategy. An exercise follows the reading; it includes both comprehension and application activities. Suggested answers to the self-checks are in the answer key at the end of the reading.

By the conclusion of this reading, you will be able to
1. explain what comprehension learning involves in your own words
2. identify correct examples of the application of comprehension-level instructional strategies

comprehension: knowing why

ability to:
explain
classify
identify relationships

At the next level of cognitive behavior is comprehension, which is demonstrated by the ability to explain or classify. At this level, the individual knows why something is; understanding of meanings, reasons, causes, and relationships constitutes this level of behavior. When an individual comprehends, s/he can use information to classify objects and events, explain the meaning of a fact (such as a definition or a symbol), and identify relationships among objects or events. The geometry student can explain what "Area" is, not merely state a formula; the chemistry student can classify chemical elements on the basis of atomic structure, not merely recall the names of the elements.

explanations

The contents of this level of learning involve explanations of why and how. Every time we explain, provide meaning, interpret, give reasons or causes, or use explanations or definitions to classify or categorize, we demonstrate comprehension. In other words, we can say that an individual comprehends (i.e., understands) when he or she can:
- explain a definition in his or her own words
- use a definition to classify or categorize objects, events, or ideas
- explain why something is
- explain how something works
- interpret information
- provide an alternate means of expressing an idea (such as a diagram, graph, or picture).

"understanding" is not a useful term

Two important points must be made here. First, the ability to comprehend involves what we call "understanding" but the term "understanding" is too vague and general to convey real meaning. Notice that each of the abilities listed above is stated very precisely and concretly, in a phrase rather than with the single word "understand". Each ability phrase is a more precise way of describing "understanding". Since it is always preferable to be as precise and concrete as possible, the more precise ability-naming phrases should be used instead of the more general "understand".

Second, information can be learned at different levels. A definition can be memorized as a fact (knowledge-level learning) or used to classify or explain (comprehension-level learning). A procedure may be learned at the knowledge level by memorizing the list of steps, at the comprehension level by explaining how the procedure works, and at the application level by demonstrating how to follow the procedure effectively and efficiently. One of the most important decisions an instructor can make is the selection of the level of cognitive behavior at which information should be learned. This decision must be made when instructional objectives are written, and there must be an exact match between the level of behavior specified in the objective, the level required in assessment and on-the-job tasks, and the kinds of instructional strategies and practice activities used to teach that particular level of behavior.

concepts

One important kind of information at this level of learning is the concept. A concept is a class or category of objects, events, or ideas which all share the same important characteristics. A concept has a name or label, a set of important characteristics that all members of the class must share, and examples or instances of the concept (entities which have all of the important characteristics and thus belong in the class or category identified by the concept). "Square" is a concept; it has critical characteristics which give it meaning: a square is:

1. a two-dimensional object
2. with four equal sides
3. and four right angles.

Any object which has these three important characteristics belongs in the category labeled "square". Learning the concept "square" involves learning to classify things as belonging or not belonging to the category on the basis of the characteristics of the category. Teaching the concept "square" thus requires presentation of the concept label, the important characteristics, and examples or instances of the concept. The learner comprehends the concept when he can correctly identify instances of squares from instances of other shapes such as triangles and pentagons.

concepts can be physical entities or ideas

Concepts can represent physical entities (such as "square" or "table") or ideas. "Friendship" is also a concept' it has a label, a set of important characterisitcs, and instances. The important characteristics are identified in a definition, just as they are for a physical or concrete concept. Again, when the learner is able to identify correctly all instances of "friendship" from a list of examples of several different types of relationships, we can say that he or she has comprehended the concept.

When an individual is asked to give reasons for something or to explain why an event occurred, she or he is really being asked to identify some critical characteristics of a concept and to determine whether that event is a member of that concept.

concepts incorporate facts

Concepts incorporate facts. Before an individual can learn to use a concept to explain or classify, he or she must learn the concept definition; thus fact learning (knowledge-level behavior) usually preceeds concept learning (comprehension-level behavior).

Comprehension learning requires three types of instructional strategies: strategies for organizing the information to be learned, strategies for enhancing the content to make it more meaningful and useful, and strategies for providing appropriate kinds of practice.

wholistic organization

layers of complexity and detail

ORGANIZING STRATEGIES. Unlike psychomotor learning, comprehension learning does not occur effectively in parts. Comprehension learning must be wholistic; that is, the entire concept, explanation, or classification must be taught as a unit, and in its simplest form at first. Once trainees have mastered ("comprehended") the simplified version, detail can be added on in layers of complexity until the desired level of complexity is achieved. For example, in the basic workshop, you studied several rules for providing instruction; one rule provided a simplified approach to incorporating practice in instruction. You learned a very basic set of strategies for providing practice opportunities. During this advanced workshop, more detail and complexity is included, which expands the instruction to a full lesson lasting an hour. Additionally, at the beginning of each workshop, you were introduced to a general model for systemizing training. The succeeding units are elaborations on that model, adding detail to the initial simplified version. Thus, this set of workshops provides an example of the wholistic approach to organizing instruction.

This type of organization is important for two reasons. First, trainees who learn the whole concept or idea can use it to understand how the details fit together; thus, understanding is improved, transferability is increased, and details are learned more efficiently without the need for excessive memorization. The simplified whole serves as a kind of scaffolding on which the details can be hung. Moreover, in this organization, details appear to belong; they make sense and are understandable.

Second, this organization allows the instructor to provide training at variable levels of complexity to suit the needs of trainees. If trainees need only a general level of understanding of a concept in order to recognize it when they are working with its characteristics then a simplified wholistic presentation will be sufficient. If, on the other hand, trainees need to be able to explain and teach the concept to others, additional levels of detail can be provided so that they will develop this more sophisticated understanding.

For example, the basic workshop has been designed to assist personnel whose responsibilities include occasional training. Thus the level of detail is low; concepts, formulae, and procedures are provided in fairly simplified form. The advanced workshop provides more depth and complexity of explanation and clarification for those individuals who need the greater complexity to do more frequent and prolonged training. Thus, the level of complexity has been varied between the two workshops to meet different needs of participants.

use examples and non-examples

Another organizational strategy includes the use of examples and non-examples to teach concepts. The trainee must be able to use the concept definition with its important characteristics to discriminate between instances that belong or do not belong to the concept category. Therefore, concept teaching should be organized in the following manner; first, the concept definition should be presented and the critical characteristics clearly listed and explained. Then, simple examples which clearly demonstrate those important characteristics should be displayed. Third, simple examples should be paired with non-examples (entities which lack one or more of the important characteristics) and trainees should be taught to discriminate between examples and non-examples by using the concept definition. Finally, trainees should practice classifying new instances as examples or non-examples on the basis of the critical characteristics. When the trainee can correctly identify new instances as belonging or not belonging to the concept, the trainee has comprehended the concept.

simple-to-difficult sequence

CONTENT-ENHANCEMENT STRATEGIES. Highlighting strategies are particularly effective for teaching comprehension-level behaviors. They should be used to serve one or more of the following purposes: 1) to emphasize, 2) to provide alternative representations, and 3) to illustrate or exemplify.

use highlighting techniques

Emphasis should be provided for important terms and concepts, for sequences, and for relationships. Strategies for providing emphasis include the use of indicator words, repetition, summaries, and visual highlighting. Notice how this reading incorporates such visual highlighting techniques as underlined captions for some paragraphs and key words and phrases in the margins alongside the text. Moreover, indicator words appear within the text and summary paragraphs conclude each reading. Finally, the list of strategies and guidelines at the end of the readings provides both repetition and summary.

use alternate representations

Alternate representations are another means of communicating information. A verbal description of a process may be alternately represented by a flow chart or wiring diagram. A definition of a concept may be alternately represented by a picture of an instance with the critical characteristics labeled. If trainees must interpret or explain ideas, they should see, and practice creating and using, various means of interpretation or explanation. A picture can be used to clarify or illustrate a verbal presentation, as can a chart or graph; a verbal description is an effective alternate representation for a visual such as a diagram. A demonstration can serve as an alternate representation to a verbal description.

illustrate ideas

Illustrated ideas are better remembered than unillustrated ones. In addition to still visual illustrations, anecdotes, case histories, and personal experiences can be used to illustrate ideas. Illustrations must be relevant and familiar to trainees if they are to be useful. When a trainee can provide an appropriate illustration for an idea, he or she is demonstrating comprehension of that idea.

practice in classifying and explaining

PRACTICE STRATEGIES. Practice is an important part of learning. Trainees must be able to practice using ideas, interpreting, explaining, classifying, and performing other types of comprehension-level skills. Practice must be provided at each level of complexity and should require trainees to perform precisely as the terminal skill requires. For example, if trainees must eventually be able to explain why a given event occurred, they must have practice in providing this type of explanation. Merely recalling a memorized explanation demonstrates not comprehension but knowledge-level learning. Thus, trainees must be helped to express ideas in their own words, to interpret or to translate.

spaced practice

Multiple practice experiences should be provided, using many examples. Practice should be spaced out, occurring in several shorter sessions during instruction rather than one long session at the end of the insturction. Trainees should be provided with *provide multiple exit opportunities*

enough examples to develop competence; those trainees who master the desired skill quickly should be allowed to move on to another activity while others who are having difficulty have access to additional practice opportunities. This is the concept of variable-exit instruction.

match practice to job performance

Practice activities should be cumulative, leading to the exact type of performance that will be required during assessment and on the job. The conditions of practice should be structured so that they eventually resemble the actual conditions under which tasks must be performed on the job. If a skill must eventually be practiced under a variety of conditions, practice should be provided in a variety of situations.

provide constructive feedback from multiple sources

Feedback for comprehension-level learning must be constructive since trainees need to know why answers are wrong and how to make corrections. Constructive feedback can and should be provided from multiple sources: the instructor, the training materials (via answer keys), and fellow trainees. Emphasis should be on guiding trainees toward correct answers, not on providing the correct answers. Cues and prompts should be provided as needed for guidance.

ensure required information is available

Finally, the instruction must provide the information trainees need to perform correctly. This necessary information must be readily accessible, either from memory or from external sources. Before a trainee can use a definition, she or he must know it; she or he can either commit it to memory or look it up in some accessible source. The instructor must ensure that the information is available, by asking trainees to state or locate the information, before they are asked to use it. Such information can be provided in oral or written form in the directions for a practice activity. Information that is crucial or is frequently used should be memorized; less critical information can be provided in procedural manuals, guides, and the like. The instructor should require memorization only if on-the-job performance requires that the information be committed to memory.

INSTRUCTIONAL STRATEGIES FOR COMPREHENSION-LEVEL OBJECTIVES

1. Write comprehension-level objectives using the more precise and concrete ability phrases such as those listed in the reading. Do not use the word "understand". Ensure that the desired behavior is, in fact, comprehension-level.

2. Identify the concepts that must be taught. For each, write a concept definition that includes the important characteristics. Specify these characteristics as clearly and as simply as possible.

3. Pare down the content to be taught until it is in a simplified form. Then create levels of detail that increase in complexity and that can be added to meet specific needs for greater complexity.

4. Analyze trainee needs and identify the level of detail-complexity that will be sufficient to meet those needs.

5. Lectures and individual assignments are the appropriate instructional methods for teaching comprehension-level skills. Demonstrations of concept-using are a necessary supportive method. Guided discussions are not useful for teaching comprehension-level skills.

6. Select examples and non-examples for concept teaching. Begin with simple and obvious examples and increase the level of difficulty until the desired level of complexity has been reached.

7. Prepare alternative representations for all important content. Use visual representations to enhance verbal presentations (lectures and readings) and verbal representations to enhance visual presentations (demonstrations and still or moving pictures). Build in exercises requiring trainees to provide alternative representations and illustrations of concepts.

8. Integrate devices for emphasizing important content. Use indicator words, voice tone and body language (for oral presentations), visual highlighting techniques (such as page layout, color, underlining, and arrows for printed materials). Create questions and exercises that require comprehension-level responses. Prepare summaries for each lesson and employ repetition of key terms and concepts.

9. Structure the instruction to provide frequent opportunities for practice. Space practice opportunities so that trainees have an opportunity to practice the skills required for each objective separately.

10. Provide enough practice opportunities and examples to enable trainees to demonstrate mastery. Provide for variable-exit by allowing trainees who master objectives quickly to move on to other activities while those who are having difficulty can continue practicing.

11. Structure practice activities so that the final practice is on the kind of task and under the same conditions that job performance requires. Provide practice under a variety of different situations and conditions to enhance transfer.

12. Provide continuous constructive feedback. Use answer keys for exercises and assignments whenever possible. Provide opportunities for trainees to provide feedback for each other. Wean trainees away from dependence on the instructor for all feedback.

13. Provide trainees with the information they need to perform effectively. Determine what information is crucial enough to require memorization; provide other information in verbal or written directions to learning activities. Ensure that trainees have the information they need before they begin an activity.

SELF-CHECK #3

1. What kinds of behaviors represent comprehension-level learning? Name at least two.

2. Why isn't the word "understand" used in comprehension-level objectives?

3. What is a concept?

4. Select a concept with which you are familiar. Write a concept definition which states the critical characteristics of the concept and name two or three examples of the concept.

5. Briefly describe how you would teach the concept you defined in #4 above.

READING #4: TEACHING APPLICATION-LEVEL OBJECTIVES

This reading is designed to introduce you to strategies for teaching rules and procedures. The definitions of the two types of application-level tasks are followed by descriptions of effective strategies for teaching each. A list of strategies follows the reading. A self-check concludes the reading; suggested answers are provided in the answer key.

By the conclusion of this reading, you should be able to

1. define "rule" and "procedure"
2. describe strategies that will be most useful in teaching each type of application behavior

application: knowing how to do

The third level of cognitive behavior is application, which is demonstrated by the ability to use rules and procedures to do, make, produce, or cause something. At this level, the individual knows how to do something; ability to use rules and follow procedures constitutes this level of behavior. When an individual applies a rule or follows a procedure, she or he solves equations, calculates, makes or produces a product, or causes an effect or result to occur. The geometry student can calculate the area of a rectangle by using the formula "$A = bh$"; the chemistry student can follow the procedure for producing salt from hydrochloric acid and sodium hydroxide.

rules and procedures

rule-learning

The contents of this level of learning are rules and procedures. A rule* is a statement of a relationship between classes or groups of things that can be applied in a variety of situations. "$A = bh$" is a rule for finding the area of any rectangle whenever the height and width are known. Often a rule may be stated in the form of an equation, using mathematical notation or symbols; other rules may be stated in verbal form. However, regardless of their form, rules are defined by the expression of a relationship between classes of things which can be used in a variety of situations. Moreover, a rule must be used (not merely stated or explained) to make, produce, or cause some product, result, or effect. Below are some examples of rules from several fields of knowledge:

- $f = ma$
- $A = \pi r^2$
- An instructional objective must contain statements of the audience, the desired behavior, the conditions of performance, and the degree of proficiency required
- $\bar{X} = \frac{\sum x}{n}$

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*We use the term "rule" to refer generally to principles, formulas, and general equations of all kinds.

-The present participle of any English verb ends with the suffix "-ing".
-Primary colors are combined two at a time to produce secondary colors.

Rule learning requires that the individual comprehend the concepts which are included in the rule. Thus comprehension-level learning must precede rule-learning. Individuals must be able to explain as well as use rules.

procedure-learning

A procedure is a set of steps which, when followed correctly, result in some product, effect, or event. An individual can follow a procedure if she or he knows what to do; understanding why the steps are included is not required. Procedures differ from rules, then, in that rules require comprehension while procedures require only knowledge of the steps. Rule-learning may include learning to follow a procedure, but rule-learning goes beyond merely knowing what to do and includes knowing why and understanding the concepts involved in the rule.

flexibility

Another difference between rules and procedures is in the amount of flexibility of each. A procedure is relatively inflexible; that is, it must be followed exactly as specified in the sequence of steps and it leads to the same result. A rule, on the other hand, can be highly flexible; formulae which contain general terms can be used to find the value of any one term if the values of the other terms are known. For example, a physics student who is learning about the concept of force is taught the rule "f = ma" (the force of an object is equal to the product of its mass and its acceleration). If students are taught the procedure only, then they learn how to calculate force when the mass and acceleration are known; they may not even understand what the concepts of "force", "mass", and "acceleration" mean. However, if the students are taught to understand the rule (to explain the individual concepts and their relationships as a rule), then they will be able to manipulate the formula to find the acceleration of an object when its force and mass are known (a = f/m) or to find the mass when the acceleration and force are known (m = f/a). Thus, rule learning permits more flexibility than procedure learning since a rule can incorporate several procedures and since the individual procedures need not be taught directly; learners can derive them from their understanding of the relationships involved in the rule.

concept comprehension

Organizational Strategies for Rule-Using. As we said earlier, the prerequisite skill for rule-learning is concept comprehension. Trainees must comprehend the concepts contained in the rule if they are to be able to use the rule intelligently. Thus the primary organizational strategies for rule-learning are instruction in the component concepts and providing prompts and cues to stimulate recall of the concepts and relationships. The instructor need not state the rule directly; in fact, it is often a highly effective strategy to guide trainees in discovering the appropriate rules for themselves.

demonstrate rule-using

The second type of organizational strategy involves providing examples of rule-using by means of demonstrations. The instructor should demonstrate rule-using by listing and following all procedures involved in applying the rule. Trainees can be asked to participate in the demonstrations of rule-using.

use highlighting techniques

Content-Enhancement Strategies for Rule-Using. Highlighting strategies are useful in teaching rules. Verbal and visual devices should be used to emphasize relationships among concepts and to provide alternative representations (i.e., verbal descriptions should always accompany symbolic or mathematical notation). Examples of rule-using must be provided; the examples should be structured in an easy-to-difficult sequence. The instructor should demonstrate rule-using, then call on trainees to provide additional demonstrations.

multiple practice opportunities

spaced practice

variable exit

Practice Strategies for Rule-Using. Practice is a critical component of rule-learning. Trainees must be able to practice applying new rules in a variety of contexts. Practice should be spaced, occurring in several shorter sessions during instruction, rather than in one long session at the end of the instruction. Many practice opportunities should be made available so that those trainees who need additional practice can obtain it. Variable exit opportunities should be available.

easy to difficult sequence

match practice to job performance

Practice activities should be structured in an easy-to-difficult sequence and should be cumulative, leading to the exact type of performance that will be required during assessment and on the job. The conditions of practice should be structured so that they eventually resemble the actual conditions under which the tasks must be performed on the job. If a skill must eventually be practiced under a variety of conditions, practice should be provided in a variety of situations.

provide constructive feedback from multiple sources

Feedback must be constructive since trainees need to know why answers are wrong and how to make corrections. Constructive feedback can and should be provided from multiple sources: the instructor, the training materials (via answer keys), and fellow trainees. Emphasis should be on guiding trainees toward correct answers, not on providing the correct answers. Cues and prompts should be provided as needed for guidance.

One effective feedback strategy involves having trainees check each other's work step-by-step. Trainees should ask each other to explain how and why each step was performed. This strategy, when used during initial practice activities, provides important repetition for both component concepts and the rules. Later practice opportunities can be accompanied only by an answer key.

ensure that required concepts and facts are available

Finally, the instruction must provide the information trainees need in order to perform correctly. This information, such as definition, statements of rules, and the like, must be readily accessible, either from memory or from external sources. Before a trainee can use a rule, he or she must know it; the rule can be committed to memory or looked up in a text or manual. The instructor must ensure that necessary information is available, by asking trainees to state or look up the information before they are asked to use it. Information that is crucial or frequently used should be memorized; less critical information can be provided in procedural manuals and textual guides. The instructor should require memorization only if on-the-job performance requires that the information be committed to memory.

organize instruction

Organizational Strategies for Procedure-Using. Organization of the instruction is the most critical aspect of teaching procedures. Trainees must have access to several different kinds of information in order to learn how to follow a procedure: what the steps are and in what order they must be performed; what the resultant product, effect, or event must look like; what special information, warnings, or concerns must be considered and when; what decisions must be made and how and when they should be made; and how the various tasks should be performed. Training in following a procedure should include the following sequence:

1. introduce the procedure: briefly explain its purpose and describe the desired end product, effect, or event.
2. list, in order, the steps involved in the procedure. Identify decision points, special concerns, and warnings.
3. demonstrate the entire procedure in a setting that is as close as possible to that in which the procedure will eventually be performed on the job.
4. discuss any decisions or special conditions involved; explain why certain decisions were made and the means for making them.
5. provide practice in carrying out the procedure.

If the procedure is very complex, it may be broken down into subsets or tasks and instruction and practice provided on each subset separately. Eventually, however, trainees must practice carrying out the entire procedure.

training in decision-making

If a procedure contains decision points, trainees must learn how to make those decisions. This type of learning may include learning how to apply decision rules. For example, a procedure for operating a piece of equipment may involve a decision related to a temperature gauge; the rule might say "If temperature gauge indicates red-zone reading, cut off heating unit". Needed rules must be taught and practiced in separate instructional activities.

familiarity with equipment

Moreover, if equipment is involved in the procedure, knowledge of the equipment must be taught separately from and prior to the application of the procedure. Trainees must be familiar with machines and materials before they learn to use that equipment to make, produce, or cause a desired result. Trainees should, at least, be able to identify the parts of the equipment, describe relevant operations, and utilize materials and machinery correctly before they learn to carry out procedures employing such equipment.

provide procedural guide

Content-Enhancement Strategies for Procedure-Using. The most useful content-enhancement strategy is providing each trainee with a hard copy of the steps of the procedure for use as a reference. The hard copy may be verbal (a list of the steps, describing each and listing decision points, warnings, and concerns) or visual (a flow chart or other diagram identifying steps, decision points, etc.), or a combination of the two. This kind of document is called a procedural guide; it provides all the information an individual needs to carry out the procedure. Such information should include the list of steps, identification of decision points and criteria for making the decisions, descriptions of equipment needed, statements of warnings, concerns, and other special information needed to carry out the procedure, and a description of the desired result. The procedural guide may also contain a procedural checklist to enable the trainee to check off each step as it is carried out. Operational manuals that come with equipment are generally not useful in their present form for procedural guides since they contain much unnecessary technical information; the procedural guides should, however, be abstracted from them.

provide practice

Practice Strategies for Procedure-Using. Practice is an essential component of procedure learning. Trainees must have opportunities to practice following procedures until they can perform within desired parameters of efficiency and effectiveness. There are three aspects of effective practice strategies.

practice on parts and on entire procedure

First, complex or lengthy procedures should be broken down into logical subtasks and step groupings. The entire procedure should be described and demonstrated first; then the subtasks and step groupings should be identified, taught, and practiced. Trainees should have opportunities to practice each of the parts and then to practice carrying out the entire procedure.

match context of practice to context of job performance

Second, the contexts of practice must reflect the contexts in which the procedures will be followed on the job. Trainees must have experience in performing under the same conditions and constraints that exist in the real world outside the training environment. If trainees may be required to follow a procedure in several different environments, they should have experience in those different environments. If procedures are highly complex, require equipment not available during training, or are used in situations that cannot be reproduced for training purposes, simulations should be used. However, care must be taken to ensure that the simulation approximates, as closely as possible, the actual situation, and that trainees treat the simulation as seriously as they would the actual situation. After each simulation, a debriefing discussion should be held to make overt the differences between simulating the procedure and following it on the job.

vary standards

Third, practice experiences can be structured using a range of standards of proficiency. Time is the most useful parameter in this situation since the amount of time allowed for a procedure can be varied. Initial practice situations may require a large amount of time; succeeding experiences should require less and less time until trainees are able to perform within time parameters required on the job. Performance standards such as accuracy or precision may also be varied. Trainees may initially have fairly loose standards to reach; eventually, however, they must reach the level of precision required for job performance. It is important to remember that trainees must be made aware, from the beginning, of final performance criteria so that they know the goals toward which they are striving.

INSTRUCTIONAL STRATEGIES FOR APPLICATION-LEVEL OBJECTIVES

I. For Rule-Using:

1. Ensure that the objective is, in fact, application level and requires rule-using.

2. Specify the rule(s) and identify all component concepts. Ensure that trainees comprehend the concepts before they are taught the rule(s). Use comprehension-level objectives and strategies to teach the concepts.

3. Identify any component procedures involved in applying the rule(s). Plan to teach these procedures (see below for instructional strategies).

4. Lectures and individual assignments are useful methods for initial presentation of rules. Demonstration is the necessary method for teaching rule-using. Guided discussion is not a useful method for teaching rule-using.

5. Provide alternative representations of rules; formulae, equations, charts, graphs, and diagrams should accompany verbal presentations and verbal statements should accompany visual or symbolic presentations.

6. Provide examples of rule-using during demonstrations; structure examples in an easy-to-difficult sequence.

7. Provide practice in rule-using through individual assignments; structure practice experiences in an easy-to-difficult sequence.

8. During practice, provide any necessary information (such as concept definitions, and statements of rules) as prompts or cues. Require memorization of such information only when job performance requires that the information be committed to memory.

9. Provide continuous constructive feedback. Use multiple sources for feedback: instructor, fellow trainees, and answer keys.

II. For Procedure-Using

1. Ensure that the objective is, in fact, application level and requires procedure-using.

2. List, in order, the steps involved in the procedure. Identify those steps and step-groupings that must be taught separately.

3. Identify decision points in the procedure and decision-making strategies or rules. Plan to teach decision-making rules separately.

4. Lectures and individual assignments are useful methods for initial presentation, description, and explanation of procedures. Demonstration is the necessary method for teaching procedure-using. Guided discussion is useful as an adjunct, debriefing experience after simulation practice experiences.

5. Provide a procedural guide for each procedure. The guide should list the steps of the procedure in order, state any warnings, concerns, and other special information, identify decision-points and decision rules, and describe the desired outcome. The guide may be in visual (i.e., graphic) form.

6. Demonstrate the procedure.

7. Provide practice in following the procedure. If the procedure is highly complex or lengthy, practice should be provided both on separate step-groupings and on the whole procedure.

8. Provide practice in all relevant contexts or situations or, at least, in a representative sample of relevant contexts. Use simulations as necessary; provide debriefing discussions after simulations.

9. Structure practice experiences through use of varying standards of proficiency. Vary time-on task and/or performance standards as needed.

10. Provide constructive feedback continually and from multiple sources.

SELF-CHECK #4

1. What kinds of abilities are defined as application-level? Name at least two.

2. What is the difference between rule-using and procedure-using? What lower-level abilities are required for each? What kind of organization is needed to teach each?

3. What is a procedural guide? What does it contain? How is it used?

4. Select either a rule or a procedure that you might expect to teach. Briefly describe how you would structure the lesson designed to teach it.

READING #5: TEACHING PROBLEM-SOLVING OBJECTIVES

This reading is designed to introduce you to strategies for teaching problem-solving skills. Since problem-solving ability is developed only over long periods of time, these strategies are more general than those you have encountered in previous readings. A self-check concludes the reading; answers are provided in the answer key.

By the conclusion of this reading, you should be able to:

1. define "problem-solving behaviors"
2. explain what a higher-order rule or procedure is
3. list some strategies for helping trainees to develop problem-solving skills.

problem-solving

skills in analysis, predicting, evaluating

novel solution

At the highest level of cognitive skills is problem-solving, which is demonstrated by the ability to create or invent solutions to problems. At this level, the individual analyzes a problem, creates a plan for solving it, and selects or generates rules and/or procedures for finding the solution. Component skills include the ability to analyze a situation, to select tentative solutions, to try out each tentative solution and assess its effectiveness, and to select the appropriate solution for the problem. Problem-solving ability differs from ability to apply rules and procedures in that, at the application level, the rule or procedure is given and the individual need only use it; at the problem-solving level, the individual is given only a problem situation, for which he or she must select or create rules and procedures and use them to find a solution. The solution created is considered novel or original in that it is new to the learner; that is, it has not been taught to the learner so that the learner must discover or invent it in order to be able to use it.

higher-order rules and procedures

The contents of this level of behavior are higher-order rules and procedures. They are referred to as "higher-order" because they are created through the combination of lower-order rules and procedures that the individual has been taught. The individual must recall these rules and procedures, perceive their usefulness in the present situation, modify or combine them to make them applicable, and then apply them. In some cases, an entirely new rule or procedure may be needed; the individual must invent it to solve the problem. Thus, any time an individual modifies or combines previously learned rules and procedures or creates new ones in order to solve a problem, the individual is demonstrating problem-solving skills.

For example, children in elementary school learn the rule for finding the area of a rectangle: A = bh. They apply the rule to find the area of many different rectangles. This is an application skill. If their instructor then gives them a parallelogram and asks them to figure out a way to find the area of this figure, the instructor is asking them to perform at the problem-solving level. The students must perceive that a parallelogram is related to a rectangle and that the figure may be modified, by the drawing of a line perpendicular to, and connecting, top and bottom. Once this line is created and a way found to determine its length, the same formula can be used to find the area of the parallelogram: A = bh. When students can perform in this manner, they are demonstrating problem-solving skills.

In other words, an individual demonstrates problem-solving skills when he or she can
- create (or generate, develop, devise, formulate, or invent) a solution to a problem
- criticize or evaluate ideas, using self-generated critical standards
- draw inferences
- integrate or synthesize information
- predict outcomes, results, or effects
- provide a justification or rationale

The development of problem-solving skills requires frequent exposure to situations requiring such skills, the opportunity to formulate and tryout multiple solutions and evaluate the effectiveness of each, opportunities to demonstrate curiosity, and willingness to persist despite frustration and failure.

difficult to teach

Problem-solving skills are very difficult to teach. They are developed over long periods of time, through frequent exposure to problem situations for which easy or simple solutions are not available. Short-term efforts can only identify and support certain useful characteristics. There are three types of strategies that are useful for helping trainees to develop the component skills and personality characteristics that lead to problem-solving ability.

ability to organize information

Organizational Strategies. Problem-solving skill involves the ability to organize information in many different ways. The individual must be able to examine a situation from many perspectives, to select from memory rules and procedures that are potentially useful in finding a solution, to create higher-order rules and procedures and try them out until a successful solution is obtained. Often, several different higher-order strategies may result in equally useful or appropriate solutions. The instructor must ensure that the trainee is able to analyze the situation accurately and to perceive all its characteristics. Moreover, the trainee must be able to recall relevant rules and procedures that have been previously learned. During initial problem-solving attempts, a large amount of guidance may be necessary to help the trainee "see" the precise nature of the problem and possible means of solving it. During later experiences, guidance must be kept to a minimum so that trainees are actually in control of the problem solution.

real and simulated situations

Both actual and simulated problem situations can be used to help trainees develop problem-solving skills. Disaster drills, such as those conducted by emergency personnel, are an effective example of simulated problem-solving situations. During the drill, medical personnel treat "victims" as if they had actually suffered injuries; spot decisions must be made and acted upon without the aid of rules and procedures. Personnel must act efficiently and correctly with little information and little time. Games and role-playing activities can be useful in developing problem-solving skills; board games can be bought commercially (two well-known examples are chess and Monopoly) which help people develop needed skills. Military war games have been used for centuries to help armies keep up their strategic skills during peace time.

games and role-plays useful

guided discussion

Guided discussions are a useful means of analyzing problem situations and evaluating solutions. However, guided discussions should not be used alone, but in conjunction with practice experiences.

Practice Strategies. Practice is essential for the development of problem-solving skills. Trainees must gain practice in analyzing situations, in developing and trying out tentative solutions, and in assessing the effectiveness of these tentative solutions. Practice experiences should be structured in an easy-to-difficult sequence, with earlier experiences involving relatively large amounts of instructional guidance and later experiences involving little or no guidance.

easy-to-difficult sequence for practice

complexity not always good

Trainees must be convinced that the effectiveness of their higher-order rules and procedures will be measured solely in terms of their usefulness in solving the problem. Highly complex or sophisticated strategies are not always preferable; what matters is the solution. Emphasis should be placed on the development of skills in creating solutions, not on the solutions themselves; that is, the instruction should emphasize problem-solving in general, rather than specific problems. Emphasis should also be placed on patience, persistence, and flexibility.

multiple perspectives

Practice on developing the ability to use multiple perspectives is also important. Trainees can be shown ordinary, familiar objects (such as a brick or a pencil) and asked to list new or different uses for each object. Viewing an event from the separate perspectives of each of the participants is also a useful means of developing multiple perspectives; role-playing experiences are useful here.

frequent and extended practice

Practice must be provided frequently, over a long period of time, and with emphasis on the development of skills, rather than on the solution to a specific problem.

motivate, encourage, support

collaboration, not competition

Motivation Strategies. Motivation plays a crucial part in the development of problem-solving skills. Trainees must manifest a desire to increase their skills despite frustration and lack of success. The instructor must provide encouragement and support, creating an environment in which failure to solve a specific problem is viewed as a learning experience and trainees work together as colleagues. Competitiveness should be kept at a minimum and collaborative effort emphasized. Guided discussions are important as debriefing sessions to help trainees share problems and concerns and assist each other in finding solutions.

INSTRUCTIONAL STRATEGIES FOR PROBLEM-SOLVING OBJECTIVES

1. Ensure that the desired behavior is problem-solving.
2. Ensure that trainees have already mastered necessary lower-order concepts, rules, and procedures.
3. Provide practice in using multiple perspectives; use simulations, games, and role-playing as necessary.
4. Provide practice in analyzing situations and defining problems.
5. Lecture is not a useful method for teaching problem-solving skills. Guided discussions, individual assignments, and demonstrations are effective methods for helping trainees to develop these skills.
6. Ensure that trainees are able to obtain information necessary for solving the problem; provide guidance (prompts and cues) as needed at first; reduce guidance to little or none in later experiences.
7. Emphasize usefulness of solution, not sophistication.
8. Emphasize the skills over the solution.
9. Motivate, encourage, and support trainees. Create an environment in which failure has nothing to do with grades or success in the training program; build confidence and encourage curiosity.
10. Encourage collaboration and discourage competitiveness. Use the team approach and encourage trainees to assess and help each other. Make assessment a tool, not a punishment.
11. Encourage trainees to seek out problem-solving experiences outside the work environment.

SELF-CHECK #5

1. How does problem-solving differ from rule or procedure using?

2. What is a higher-order rule or procedure?

3. Imagine an ordinary drinking glass. Suggest at least five uses for it in addition to a container for liquids.

4. What motivational support should an instructor provide during problem-solving activities?

READING #6: TEACHING PSYCHOMOTOR OBJECTIVES

This reading introduces you to the techniques for teaching a motor skill. It introduces the concepts of motor task analysis, executive subroutine, and psychomotor skills.

By the conclusion of this reading, you should be able to:
1. define each of the following: motor skill, executive subroutine, psychomotor skill
2. state the guidelines for teaching a motor skill.

motor skill

A motor skill is a performance whose outcome is reflected in the rapidity, accuracy, force, or smoothness of some bodily movement. A motor skill thus involves some sort of physical activity; it is evaluated in terms of one or more of the following criteria:
- a) the rapidity or speed with which the action is performed
- b) the accuracy or precision of the action
- c) the force or power of the action
- d) the smoothness or agility of the action

Some motor skills involve gross bodily movements, in which all or most of the body is involved. For example, the motor skill of serving a tennis ball involves the arms, the legs, the trunk, and the head, all of which must move in precise co-ordination to serve the ball efficiently. Other motor skills involved very small movements, in which only a few muscles are involved. For example, the skill of printing a capital letter "A" requires only the muscles of the arm and hand and eye-hand co-ordination. Whether the task requires gross bodily movement or relatively limited muscular activity, a motor skill is identifiable in its requirement of rapidity, accuracy, force, and/or smoothness. An instructional objective for a motor skill will require one or more of these performance criteria in the statement of desired behavior and the statement of acceptable performance. An objective for a student in a typing class might look like this:

> The student will type a single page of copy containing 250 words at 50 words per minute with no errors.

Notice that the objective specifies a physical activity (type) and two of the performance criteria for motor skills: rapidity (50 words per minute) and accuracy (no errors).

cognitive component

Although motor skills focus primarily on physical movement, there is a cognitive component involved. In order to type a page of copy, a secretary must know how to type capital letters. This skill has two components: a physical one which involves learning how to hit the shift key and a cognitive component which involves *psychomotor skill*

learning when to hit the shift key. A tennis player must learn both how to make the various movements involved in serving the ball and when and in what order to make the movements. Thus motor skills are usually called psychomotor skills to indicate that both components--physical and cognitive--are involved.

executive subroutine

The cognitive component of a psychomotor skill includes the knowledge of when and in what order the various motor activities must be performed. The timing and sequencing of motor activities constitute what is called the executive subroutine, a term borrowed from computer science. The executive subroutine is a set of instructions on how to integrate and co-ordinate the various individual physical movements of the motor skill. When teaching a motor skill, it is important to teach both the individual motor activities and the executive subroutine.

task analysis of skill

To prepare instruction on a psychomotor skill, begin with a task analysis of the skill (see Unit Two, Analysis, for description of a task analysis); the Task Detailing Sheet may be used for a motor skill. The task analysis will help you to identify the component activities and steps that comprise the motor skill, necessary sequences in which the activities must be performed, and the executive subroutine. Watch an expert perform the skill and note each separate component movement. Ask the expert to "talk through" the series of movements, describing each as it is performed. Pay special attention to the executive subroutine; note all directions and instructions, warnings, and any special information that a novice would need in order to perform the motor skill. Then ask a novice to perform the skill by strictly following the activities and instructions detailed in the task analysis. This step provides you with an early indication of the usefulness of the task analysis; if it is useful, the novice should be able to demonstrate the skill, although not as efficiently or confidently as the expert. Repeat these steps of task analysis and novice try-out until you have a useful task analysis.

After the task analysis has been completed, prepare instruction on the executive subroutine, the component activities, and the complete motor skill. The instruction should include the following:

description and demonstration

1. description and demonstration of the complete motor skill. This introductory step serves as a preview of the entire instruction and provides trainees with a knowledge of how the final performance should look. Moreover, viewing the entire performance assists trainees in understanding the role of the component activities they will be mastering. The description can be in the form of a page of prose (such as this page), a numbered set of steps (such as appears on a checklist), or a flow chart (useful for very complex motor skills). Each trainee should have a description of the motor skill. Regardless of its form, the description should

contain (a) an ordered set or sequence of steps or movements which comprise the motor skill, (b) notices, warnings, and constraints, or other special information which must be considered when performing any or all of the component skills, and (c) statements of performance standards against which the motor skill will be judged (such as time limitations, degree of precision, etc.). The demonstration may be live or simulated (such as on a film); it should show clearly how the final performance should look and what the result of acceptable performance will be. Trainees should have regular access to such models of acceptable performance. Films are particularly useful demonstrations since they show movement, permit slow-motion and stop-frame techniques, and are available whenever a trainee needs to review a model of performance. Provide still visuals, such as pictures and diagrams, to demonstrate specific points or positions.

2. Ensure that trainees possess the prerequisite skills and knowledge to begin learning the motor skill. Provide any necessary remedial instruction before beginning instruction on the motor skill.

3. Provide specific instruction on all important component skills with which trainees are unfamiliar. Provide instruction on the executive subroutine.

part and whole practice

4. Provide practice on all important component skills and on the whole skill. Practice should be distributed over time since research has shown that several short practice sessions are more effective than a single long session. Moreover, even after trainees have mastered the motor skill, occasional practice should be provided on the whole skill to refresh the learning and deter forgetting.

constructive feedback

5. Constructive feedback should be provided consistently and constantly during the learning of a motor skill. For initial training activities, the instructor may be the best source of constructive feedback; however, once trainees have begun to master the skill, they can provide each other with useful information. Trainees can take turns coaching and criticizing each other's performance.

vary standards of performance

6. During training, use increasingly more rigorous standards of performance as feedback criteria; begin with very loose standards and, as trainees become more proficient and more confident, increase the standards until trainees are performing at or above the minimum acceptable standards. Involve trainees in setting the intermediate standards; keep them continually aware of the final, required levels.

INSTRUCTIONAL STRATEGIES FOR PSYCHOMOTOR OBJECTIVES

1. Identify content to be learned as a motor skill; ensure that what is to be learned reflects physical activity that can be evaluated in terms of the rapidity, accuracy, force and/or smoothness of some bodily movement.

2. Write an instructional objective that reflects one or more of the standards listed above and requires some physical movement.

3. Perform a task analysis on the motor skill, using an expert and identifying (a) the performance sequence of activities and movements which comprise the motor skill, (b) the executive subroutine (set of directions and instructions for integrating and co-ordinating the component activities), (c) the warnings, constraints, and other special information trainees will need to perform the motor skill, (d) the final performance standards and criteria against which skill mastery will be evaluated. Have a novice try-out the task analysis to ensure that it results in desired performance.

4. Ensure that trainees have mastered all prerequisite skills and knowledge before they begin to learn the motor skill.

5. Provide models of desired performance; live or simulated demonstrations are the most effective instructional method for teaching motor skills. Lectures and assignments should be used only in support of demonstrations. Guided discussion is not a useful method for teaching psychomotor skills.

6. Provide practice on component skills and on the whole skill. Distribute practice time so that several sessions are possible.

7. Provide constructive feedback consistently and constantly. Involve trainees in providing guidance and feedback to each other.

8. Vary standards of performance during training; begin with fairly loose standards and increase rigor as trainees become more proficient.

SELF-CHECK # 6

1. What is a motor skill? What characteristics identify a skill as motor rather than cognitive or affective?

2. Why are motor skills often called "psychomotor skills"?

3. What is the executive subroutine? What role does it play in motor skills?

4. When should practice be provided during motor-skill learning?

5. How should feedback be provided? How often?

6. Why is demonstration the most effective method for teaching motor skills?

READING #7: TEACHING AFFECTIVE OBJECTIVES

This reading introduces strategies for teaching affective objectives. A discussion of four different types of affects--beliefs, values, attitudes, and interests--is followed by strategies for helping trainees to develop more appropriate attitudes and to tap interests. A self-check follows the reading.

By the conclusion of this reading, you will be able to:

1. identify strategies for assisting in effective attitude formation and interest development.

affect: an internal state

motivation derives from affect

Affective learning involves the development of interests, attitudes, values, and beliefs. An affect is an internal state which governs an individual's choice of actions. It results in a tendency to approach or avoid whole classes of objects, ideas, people, and events. An individual's motivation to do something or to strive toward some goal derives directly from his or her affects. Yet since an affect is an internal state, it cannot be observed directly. What can be observed and measured is the behavior that is guided by the affect. Because an individual has certain values, beliefs, and attitudes, he chooses one set of actions over another; this choice results in overtly observable behaviors from which attitudes, values, and beliefs can be inferred.

For example, a man who values religion and believes in the importance of divine guidance in his life will demonstrate these beliefs by joining a church or synagogue, attending regularly, participating in related activities, and giving his time and money to support religious endeavors. His behaviors overtly demonstrate his beliefs.

not directly teachable

Of all the types of behavior, affect is most difficult to teach, and almost impossible over short periods of time. Values and beliefs are developed beginning in infancy; the influences of family, religion, and community are pervasive and long-lasting. They result in a set of values and beliefs that are stable and enduring. Public educational systems assist in the transmission of cultural values and beliefs. By the time an individual has graduated from high school, he or she has developed a value and belief system that is extremely resistant to change and is usually affected adversely only by situations and events that have strong shock value. War, catastrophic illness or injury, and disaster are the usual means for effecting a changing in values and beliefs.

The values that an individual holds serve to motivate the individual. Thus motivation stems directly from the value system that characterizes the individual. Activities that are congruent with the value system are intrinsically motivating; that is, an individual derives satisfaction or pleasure from doing something that is a reflection of his values. External rewards are unnecessary since the activity serves as its own reward. For example, a woman who places a high value on being a good mother derives intrinsic satisfaction from spending time with her children. The more time she spends playing with and teaching them, the more satisfaction she derives. And the greater her satisfaction, the more time she wants to spend with the children. Thus, motivation in general, and especially intrinsic motivation, is derived from one's value system (for a further analysis of motivation, see Unit Seven, Lesson Four).

attitudes: approach or avoidance tendencies

Attitudes are less resistant to change. An attitude is a tendency to approach or avoid classes of objects, events, people, or ideas. A positive attitude results in approach tendencies; that is, an individual tends to seek out, or not avoid, certain ideas, objects, events, or people. For example, a young girl with a positive attitude toward reading may choose to spend her leisure time reading, select school projects involving books, join book clubs, and ignore social activities in order to spend more time reading. As she grows older, this attitude should continue; reading will always be an important part of her life, and she will pass on to her children her example of a positive attitude toward reading.

A negative attitude results in avoidance tendencies; that is, the individual seeks to avoid certain experiences, ideas, or people. A boy who dislikes sports will refuse to participate in sports activities, to watch them, or to read about sports events or personalities.

attitudes are predispositions to behave in certain ways

reference groups affect attitudes

Attitudes are always directed toward or against something; they are predispositions to behave in certain ways. Since they are learned, they can be unlearned. However, the more long-lasting an attitude, the more difficult and time-consuming the unlearning will be. Also, the support an attitude receives from important reference groups such as family, ethnic group, and peer group, the more resistant to change an attitude will be. Attitude formation depends on several variables, including the degree of congruence between the attitude and the individual's value system, the influence of reference groups, and the individual's perception of the relative pay-offs (rewards and punishments) associated with both maintaining and changing the attitude. For this reason, prejudice is so difficult to defeat; prejudicial attitudes toward members of various ethnic and religious groups are the result of long-term behavior by large groups of people. The support of entire communities for the continuation of prejudicial attitudes prevents the prejudice from being removed.

attitude change can be influenced but not taught

Although attitudes can not be directly influenced for change, if the individual perceives that changing an attitude can result in some desirable reward (such as respect from someone the individual admires), then that individual can be influenced to change the attitude. Notice that the operative word is "influenced", not taught. For adults, teaching attitudes is impractical since attitudes are already formed. Instead, if the contingencies can be arranged so that demonstrations of the desired attitude are rewarded or positively reinforced and demonstrations of negative attitudes are ignored or punished, then the adult can be influenced to change the attitude. Persuasion is far less effective than are demonstrations of desired attitudes by people the individual admires and respects. Influencing an attitude change thus requires an indirect teaching method called modelling: the desired attitude is demonstrated in terms of actions which would result from holding a particular attitude. Role-playing, games, and guided discussions reinforce the demonstrations. Adults then choose to change an attitude if the new attitude is perceived as desirable and rewarding.

modelling

interests are preferences

Interests reflect attitudes and values in a very loose way. They represent preferences for activities and experiences which are fairly short-lived and impermanent. Interests are easily changed and are most directly influenced by outside agencies such as family, peer group, and job. Novelty, curiosity, and trends or fads also directly influence choice of interests. For example, after moving to a new town, a man with no prior interest in gardening may discover that one of the most important events in the town's calendar is the annual rose festival. After watching the time and energy his neighbors invest in growing roses and noting the number of social events revolving around gardening clubs and activities, the man may develop an interest in gardening.

Helping an individual develop specific interests can be fairly simple. It may involve merely exposing the individual to several kinds of activities, making him aware of the benefits (both intrinsic and extrinsic) attached to the activities, and providing access to participation in the activities. Standardized interest inventories are available as an objective means of determining peoples' interests. However, since interests are fairly changeable, the same inventory given to a person at two different points in time may produce significantly different results.

modelling: learning by observation

admiration and respect for model

Strategies for Influencing Attitude Formation. The most effective strategy is modelling, an instructional situation in which trainees observe some individual who demonstrates the desired behavior. This method of learning by observing requires that the model be observed performing an action which derives from a desirable attitude; the model must be observed receiving intrinsic satisfaction or pleasure from the behavior. Moreover, the model must be a person who is admired and respected by the observers so that the behavior is perceived as worthy of imitation. When the model is observed deriving intrinsic satisfaction from the behavior, observers gain vicarious satisfaction. The modelling process must be repeated often, using different models when possible, all of whom are admired and respected by trainees. Observations should be followed by guided discussions on the implications of the desired attitudes, reasons for attitude change, and the effects of observing the modelling on trainees.

role-playing

Additional strategies for attitude formation include the use of simulations and role-playing, which should be designed to make trainees aware of the desired attitudes and resulting behaviors, the consequences of developing and failing to develop desired attitudes, and the relationship between simulated and actual behaviors. Role-playing activities are an especially useful attitude-formation device for working with adults. Adults can be asked to play roles that differ markedly from their own set of values and attitudes. For example, in a role-play activity to develop an attitude of tolerance toward people of different political beliefs, an extremely conservative individual may be asked to role-play a person holding liberal beliefs and a liberal asked to role-play a conservative. After the two have role-played a confrontation over some controversial issue, their audience can discuss perceptions of the two positions; equally important, the two players should discuss their feelings about "stepping into someone else's skin". At the end of each role-play, guided discussions permits both players and audiences to share perceptions and feelings.

models need high credibility

Some characteristics of modelling and role-playing are worth noting. First, in modelling, the model must have high credibility; expertise is the most important component of credibility and trustworthiness is also important. Equally, the model must be attractive to the audience; sports and entertainment figures and heroes usually have high attractiveness, while political figures are often less attractive and viewed as less trustworthy.

active participation better than observation

In role-playing activities, active participation produces greater potential for change than does observation. Therefore, the strongest proponents of undesirable attitudes should be invited to take roles. Participation should be enforced by participation in debriefing discussions after the role-play activity.

influence of reference groups

Third, people are strongly influenced by the reference groups in their lives. Resistance to changing from a group-held attitude is related directly to the degree to which an individual values the group and to the kind of reward involved in maintaining adherence to the group's attitude.

INSTRUCTIONAL STRATEGIES FOR AFFECTIVE OBJECTIVES

ATTITUDES AND VALUES CANNOT BE TAUGHT DIRECTLY; INSTEAD, THEY ARE INFLUENCED, OVER LONG PERIODS OF TIME, BY A VARIETY OF FACTORS INCLUDING FAMILY, COMMUNITY, PEER GROUPS, AND THE LIKE.

1. Desired attitudes should be modelled consistently by the instructor; attitudes are acquired and changed by imitation.

2. The cognitive component of an attitude can be dealt with through guided discussions which focus on the meaning and implications of the attitudes, the behaviors associated with them, and the consequences of such behaviors. Trainees should be guided toward recognizing the implications of holding certain attitudes.

3. Lecture and individual assignment are not effective methods for influencing attitude formation. Guided discussion, demonstration (modelling), and group activities such as role-playing and simulations are useful methods for influencing attitude formation.

4. Modelling is an effective strategy for influencing attitude formation.
   a) the model must be an individual who is respected and admired by trainees.
   b) the model must be observed demonstrating the desired behavior and deriving intrinsic reward from the actions.
   c) trainees need multiple exposures to models.
   d) discussions should be used to analyze the attitude, resulting behaviors, and consequences.

5. Role-playing experiences are useful to help trainees understand how other people feel.
   a) roles and situations must be clearly delineated but actual scripts should not be used. Players must have the freedom to interpret situations and roles as they see fit.
   b) players should be selected for roles that differ markedly from their own beliefs and values.
   c) role-plays should be brief (no more than 5 minutes) and highly focused on a specific situation.
   d) debriefing sessions should focus on how players felt as they acted out roles very different from their own personalities and on what the audience perceived and felt as they watched.
   e) two or three role-plays are usually sufficient to deal with any one situation; the role-plays should not be repetitions of each other but should focus on different aspects of a situation or on different but related situations. Different players should be used in each.

6. Attitude formation activities should include overt attention to and discussion of the roles of reference groups in an individual's choice of actions. Suggestions for resisting group pressure and for devising alternate reward structures should also be discussed.

SELF-CHECK # 7

1. Why can't an attitude or value or belief be measured directly? What can be measured?

2. What is an attitude? How are attitudes formed?

3. What are two effective means for influencing attitude formation?

4. What is an interest? How can an instructor help trainees develop interests?

5. Name an interest you have had over the past year. Briefly explain how you developed the interest.

6. Name two or three attitudes that you have perceived that are detrimental or inhibiting to your ability to do your job effectively. They may be held by co-workers, management, or anyone else who might affect your work.

ASSIGNMENT 7.5

Answer Key

SELF-CHECK #1

1. ___ a)
   C b)
   C c)
   ___ d)
   C e)

2. Knowledge: e.g., labels the parts of a diagram of a pH meter

   Comprehension: e.g., explains the meaning of the term "Neutral Solution"

   Application: e.g., performs the suspended solids test

   Problem-Solving: e.g., correctly diagnoses the malfunction in an electrical circuit

3. Cognition refers to all the intellectual processes of knowing, thinking, reasoning, and remembering.

SELF-CHECK #2

1. facts

2. When each would be learned as a fact

3. 5 - 9 (or 7 ± 2)

4. a memory device such as a rhyme

5. yes a)
   yes b)
   no c)
   yes d)
   no e)

SELF-CHECK # 3

1. explaining, classifying, concept-using
2. it is general and imprecise
3. a class or category which has a label, a set of critical characteristics which must be possessed by all members of the concept-category, and instances
4. e.g., learning (label)

   is an internal change in an individual's ability to do something that is relatively permanent and enduring (definition)

   learning to tie a shoelace
   ability to perform the suspended solids test
   skill in driving a car (instances)

   blinking my eyes when dust blows (non-instance)
5. First, teach the label and definition at knowledge level.
   Then teach concept by presenting examples and non-examples, in an easy-to-difficult sequence, emphasizing the important characteristics in the examples.
   Finally, provide practice in using the concept definition to classify new entities as examples or non-examples

SELF-CHECK #4

1. rule using and procedure following
2. rule using requires comprehension of component concepts while procedure using involves only knowledge of the correct sequence of steps in the procedure. For rule use, teach concepts before rules; for procedure use, teach sequence of steps.
3. a document that identifies the list of steps (in order), important warnings, special equipment, and other important information, and describes the final product. Trainees use it as a reference to guide them in following the procedure.

SELF-CHECK #5

1. problem solving involves selecting a rule or procedure rather than merely following one that has been given to the individual.

2. a rule or procedure that has been created from simpler rules or procedures for use in problem solving

3. a stethoscope
   a magnifying glass
   a door stop (when filled with sand)
   a protective covering for a new plant
   a prism

4. encouragement, support, an environment in which failure to solve problems is not penalized, a collaborative environment

SELF-CHECK #6

1. a skill requiring physical activity. reflected in the rapidity, accuracy, force, or smoothness of physical movement

2. because a cognitive component is involved

3. the set of directions for integrating the individual physical movements

4. practice should be continued, on both whole and part skills, and not saved up for the end of the lesson; it should be spaced out

5. provide constructive feedback constantly from multiple sources

6. because trainees must see the movements before they can reproduce them.

SELF-CHECK #7

1. because it is internal
   behaviors resulting from affects can be measured

2. a fairly permanent disposition toward or against something. They are formed over long periods of time by examples from family, religious, ethnic, and peer groups, and experiences

3. modelling and role-playing

4. a fairly short-lived preference for activities and experiences

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT EIGHT
USING AND DEVELOPING MEDIA

Estimated time for unit: Four hours

The CONTENT of this unit:

This unit is primarily concerned with how to use media in instruction. It discusses five general steps of media utilization which may be applied to any medium. One especially useful and versatile medium, overhead transparencies, is covered in detail. Both utilization and production concerns are covered in a self-instructional assignment.

The OBJECTIVES of this unit:

After completion of this unit you should be able to:

-list and explain each of the five steps in effective utilization of media in instruction
-describe at least four things which should be considered in each step to ensure effective use of the media
-apply the five steps to any medium selected to meet an instructional need
-describe four advantages of the use of overhead projectors.
-describe four advantages of transparencies as a medium of instruction
-describe four techniques for using the overhead projector effectively
-describe three factors to be considered in creating effective transparencies.

The PURPOSE of this unit:

The effective use of media in training requires planning and preparation. Good presentation and practice sessions don't just happen because the medium used is especially good. In fact, a poorly produced mediated material can be very effective if used wisely by a prepared trainer. This unit provides useful information for planning to use media in a presentation.

The RESOURCES for this unit:

1. Assignment 8.1: Effective Utilization of Media in Instruction
2. Assignment 8.2: Production and Use of Transparencies on the Overhead Projector

UNIT EIGHT: USING AND DEVELOPING MEDIA
LESSON 1 of 2: UTILIZATION OF MEDIA IN THE TRAINING SESSION

ASSIGNMENT 8.1 EFFECTIVE UTILIZATION OF MEDIA IN INSTRUCTION

Estimated time: 45 minutes

The use of media in instruction is no guarantee that learning will occur. However, if media is selected on the basis of its potential contribution to the accomplishment of a specific objective and the proper steps are taken to utilize it effectively there is reason to believe that learning will take place effectively and efficiently. Consideration of the use of media in instruction must begin with an awareness of the importance of ME in Media. If media is to have meaningful impact on instruction it will be dependent on how well the teacher uses it.

The purpose of this assignment is to introduce you to the five steps which must be considered in effectively utilizing media. These are selection, teacher preparation, student preparation, presentation of the material and follow-up and evaluation. As you plan for the use of media it is essential that you consider in detail each of these factors in effective utilization. Although each media may have slightly different utilization characteristics each of these factors is applicable. This unit will consider media as a total group and where appropriate, specific media will be used as examples.

OBJECTIVES: After completion of this unit you should:

1. List each of the five steps in effective utilization of media and tell why each is important in planning for the use of media in instruction.
2. Given any one of the five steps in effective utilization, describe at least four things which should be considered in that step if the media is to be used effectively.
3. Given a medium selected by yourself and an instructional need, describe how each of the five steps would be implemented to effectively utilize the medium.

DIRECTIONS: Complete this assignment. Your instructor will discuss with you each of the five steps in effective utilization of media. After discussion of each step you should apply the information in the unit in planning for the use of media in a particular teaching-learning situation in which you are involved.

One of the major concerns and responsibilities of every instructor should be to see that the time trainees spend in various learning activities is spent as profitably as possible. Stated another way, our responsibility is to help each student gain maximum educational benefit from the training which we plan and implement. We must use the limited amount of time we have as wisely as we know how. To make sure we do this, every instructor should consider the five basic steps in effective utilization. These are:

-selection of the media material
-teacher preparation for use of the material
-student preparation for use of the material
-the use of the material
-the follow-up activity and evaluation

Each of these steps is important. To leave out one of them in your planning is to lessen the value of the others. If each is considered seriously in your planning, the potential for a significant contribution to learning from the use of media is increased. This reading will consider each of these five steps as they apply to the utilization of media in instruction.

Selection of the Media Material

We begin the task of effective utilization with the selection of the material. The selection of the media has been considered in detail in another unit dealing specifically with this topic. Here we will consider the merits of selecting a particular material -- which film, filmstrip, recording, or slide program should be selected. You may have few alternatives as to which material you will use due to problems of availability. Even if this should be true, it is important to be aware of the considerations of selection.

Selection of any specific material must be based on its contribution to the accomplishment of the objectives of the lesson. You must answer the question, "Will this material efficiently and effectively assist my students to accomplish the objectives of the lesson?" This question can best be answered after previewing various materials and selecting the material which in your judgment is most suitable. It should be pointed out at this point that without specific learning objectives there is no basis for beginning the task of selection. It has been said that if you don't know where you are going, any road will get you there. At the same time, once you have a destination there may be alternate ways of getting there and you must decide which way is best for you. As you consider the relationship of the material to your objective you will want to determine whether the content has a high positive correlation with your lesson or whether most of the material is irrelevant. Often you will find material that will not be useful in its entirety. You may be able to use appropriate sections, if that is all that is available.

A second factor in selection is the accuracy of the information. Related to this is the consideration of whether the information is up-to-date. In areas which are changing rapidly because of technological developments this is very important. In all areas of environmental control you will be concerned with whether the material portrays the latest developments in that area. Does the material show equipment and methods which are in use today so that trainees can relate the information to situations in which they may find themselves? Technology changes rapidly and it is possible that parts of any material may be out of date. This should not prevent you from using the material if you are aware of the problem and make sure that your students are aware of the changes. Do not confuse being up to date with clothing styles or other social changes. As you are aware, clothing styles change rapidly, perhaps more rapidly than the information presented in the material. You do need to be aware of the differences in clothing styles. So do your students since such things may receive more attention than the relevant content.

Another factor which should be considered in selection is the ability level of your students. Some questions you will want to answer are: Does the material present the concept or skill to be learned in a way which is appropriate for the ability level of your students? Is it designed for persons with a higher educational level? Does it consider the topic in too great detail? Is the vocabulary used appropriate for the level of your students? Can materials be locally produced or found which would have a better chance of reaching your students where they are in terms of ability? The emphasis here is on the ability of your students and of course this means both individually and collectively. Each student and/or group of students may differ significantly and this will affect your selection as you evaluate materials on the basis of the ability level of the particular group with whom they are to be used.

Closely related to the ability of students is their background and experiences. Do they have the prerequisite skills or have they acquired the prerequisite knowledge which will allow them to benefit from the content of the material as it is presented? It is important in selecting materials that we know something about the previous experiences of our students in the area under consideration so that we can select material based on realistic information on their knowledge and skill. Be careful to select materials based on the students' knowledge and skills, not yours. Your knowledge of a subject as a teacher may cause you to see the material as very simple to understand, but your students may find it very difficult. Although it is not part of this step, it is important to note here that if you determine that your students do not have the prerequisite knowledge and skills to benefit from the use of specific material, that this readiness be developed before the material is used.

Teacher Preparation for Use of the Material

The second step in effective utilization of media is that of teacher preparation. This is the key to all the steps to follow. It is at this point that you consider how you will use the materials to accomplish the objectives of the lesson. With materials such as films, filmstrips, sound filmstrips, audio tapes, disk recordings and video tapes you begin to prepare yourself by previewing the materials with pencil in hand making notes on the content, vocabulary and important concepts presented. It is impossible to overstress the importance of previewing materials before they are used. No one would think of trying to teach from a textbook they had not read, but many a time have teachers tried to teach with media they had not previewed. Without previewing you cannot determine whether the material has a high positive correlation with your objective, its appropriateness for your students' abilities and backgrounds, the best way to introduce it, what you and your students will do during the presentation of the material and what kind of follow-up activities are most suitable after the material is used. As a result of previewing the material, you will establish precise objectives for the use of the material based on your analysis of the content. You will want to ask the question: What behavior do I want my students to exhibit after the use of this material?

As part of your preparation you will want to make sure your knowledge of the topic is adequate. There may be concepts, skills and information presented with which you are not sufficiently familiar. If so, you may need to do some further study to be able to handle questions and problems which may arise in using the material.

No one medium is the solution to the needs in a given area. Gather together whatever supplementary materials you will need to enlarge upon or clarify the concepts presented. If you are using a film perhaps you will need a transparency, slide series, model, chart or specimen to help in establishing the ideas, skills or information in the film. In using a film which explores primary or secondary waste water treatment series you could use a transparency to show all of the components of the system prior to showing the film and use the same transparency and a set of slides showing a local primary treatment system after the film to help students apply the information from the film to their own situation. If you wish to follow up the film with a demonstration or have your students carry out some learning activity you will want to make sure that you have arranged for the necessary materials.

Last, but certainly not least, take care of the physical arrangements. Make sure the room is suitable in terms of amount of space required and the need for darkening facilities. Check in advance to see if the proper equipment is available and that you are competent in its operation. A well-planned presentation can lose much of its impact if the teacher does not know how to competently operate the equipment. Know what to do when problems arise in the operation of projection and audio equipment. They frequently do.

As a transition to the next step in effective utilization -- that of student preparation -- the factors which affect the amount of learning which will take place will be considered. Although they will not be considered in detail, an awareness of these factors should help you to better understand and appreciate the need for careful planning and for adequate student preparation.

Students learn better, more effectively, and learning is longer lasting:

1. When they are actively involved in the learning process, when they do something rather than having something done to them.
2. When there is immediate feedback of the consequences of periods of time to find out if their responses are correct.
3. When the learning activity is perceived to have validity, that it is relevant to their important concerns.
4. When they are interested in or enthusiastic about the learning activity.
5. When their reactions to the learning activity are reinforced by the reactions of others.
6. When the learning activity is carefully designed to accomplish clearly conceived objectives.

These conditions or factors which affect the quality and amount of learning are closely related to the concept of motivation and reward. This concept is considered in detail in the component of this course dealing with this topic.

Student Preparation for Use of the Materials

The step of student preparation is sometimes referred to as student motivation, and that certainly is an important part of it. It is sometimes referred to as the introduction or developing student readiness. It is, in fact, all of these things.

Some of the specific things which should be considered in preparing the student are:

1. The objective of the lesson and of the material being used. Discuss with the students the objectives and make sure they understand what they mean in terms of their expected behaviors. Seek to establish the validity of the objective. Students will attend more diligently to those things which they perceive as being important to them. This can be done by helping the students see the correlation between the objective and the ultimate goal of the students.
2. Knowledge of the topic. Try to ascertain how much the trainees know about the topic. The importance of this has been touched on before. It is your responsibility to make sure that students have the prerequisite skills and knowledge which are essential to understanding the material to be used. This could be described as an element of student readiness.

3. Vocabulary - New or difficult words, or words used in a new context can create confusion and lessen the effectiveness of the material. Identify these new terms and help students to understand their meanings within the context of the material to be used.

4. Assign responsibility for content included in material used. Indicate to students what they will be responsible for after listening to or viewing the material. If students are not listening or looking for something it is very probable that they will see or hear nothing. They need to be prepared to do selective viewing and listening; to look and listen for those things which are important for the accomplishment of the objectives. This will provide for meaningful involvement on the part of students. To facilitate this you may want to provide students with an outline to be filled in, a list of questions to be answered, solutions to identified problems, or processes to be followed. These structuring or organizing techniques will particularly enhance the learning of lower ability students.

5. Use other materials to develop basic ideas. It may be easier for a student to understand a film on the primary or secondary treatment of waste water if a series of transparencies are used to show a basic diagram of these systems and particular functions of equipment and processes within the system.

Student preparation can be summarized as the time when students are made ready for the learning activity in terms of their motivation, involvement and the prerequisite knowledge and skills which will allow them to gain maximum benefit from the activity.

The Use of the Material

When you "sense" that the students are really ready for the presentation of the material you will proceed with this step. I use the statement "sense that the students are ready" because that may be the only thing you will have on which to base your decision. If you have considered those things suggested, your students, as a group, should be ready. This is not the time, however, to sit back and relax. You still have a role to play. During this step the student should be actively involved. This involvement may be through the awareness of the student to look or listen for specific ideas, information or skills or it may come through discussion and interaction during the presentation of the material. All students profit from active participation during the presentation of materials. During the step of teacher preparation you will decide how this active participation will take place. Discussion of individual filmstrip frames, stopping the film or sound filmstrip projector or recorder for discussion and clarification of ideas presented will keep the student actively involved. The decision to use these techniques can only be based on your evaluation of the needs of your particular students. There are no rules or even guidelines which can be provided. Only you can decide that a film should be stopped for discussion or reversed to look at a sequence over again or other material used to clarify the concept presented. You should feel free to move from a motion picture to a transparency, model, slide, specimen or other material and back to the motion picture. The attitude that once projected materials or audio materials are started they should not be interrupted is based on tradition and not good teaching techniques. Such a practice does not always provide for the desired involvement or any response which would indicate to the instructor or student that the material is understood. Through the act of making active responses during the presentation, lower ability students particularly will be able to compensate for poorer memories and processing skills. If through discussion during a presentation you discover that students do not understand the information presented you may determine at that point that it is desirable to reverse a film, video tape or audio tape and look at or listen to a sequence a second time. In the case of a sound film-strip, motion picture, video tape or sound-slide program you might decide to narrate the material yourself to try to clarify the information or concepts presented.

The responsibility for teaching, planning and implementing student learning activities, is yours. The responsibility for learning is the students'. Students will have a difficult time fulfilling their responsibility unless you as a teacher make every effort to provide a learning experience which is appropriate for the student and which offers maximum opportunities for feedback and response so that you can modify your approach if learning is not occurring.

Follow-up and Evaluation

The final step in effective utilization is referred to as the follow-up and evaluation. Evaluation is considered with the follow-up as opposed to being a separate step because as the follow-up activities are implemented you will be evaluating the learning which has taken place and your own lesson planning. The types of follow-up activities which are appropriate are dependent on the objectives of the lesson. If the material presented involves the teaching and learning of certain skills it would be appropriate for the student to practice the skills presented. Other activities might be discussion, role playing, problem solving, research, construction activities, experimentation, field trips, use of resource people or panel discussions. The follow-up activities should provide the students with an opportunity to use or apply the knowledge or skills they have learned. The follow-up activities should be used not only to find out what students learned, but what they didn't learn that is related to your objectives. If there are important things which were not learned you will have to decide how to modify your approach to provide those experiences which will permit the student to accomplish the objectives. This may mean showing projected materials a second time or using other materials and activities to clarify problem areas.

Often times the follow-up activity consists of such questions as "Does anyone have any questions?" or "What questions do you have about the material shown?" or "Do you all understand this now?" or "Are there any questions?" Usually the response to these questions is less than overwhelming. Such questions indicate poor planning. Students have a difficult time responding when they don't know what they were supposed to learn to begin with. There is a need to structure the follow-up activities in such a way as to give students an opportunity to use or display the knowledge or skills they have learned which would indicate the desired behaviors you determined for the material and the lesson. Appropriate valid follow-up activities help to provide motivation for future use of materials as they help the student to develop an appreciation and an understanding of the value of media presentations in assisting them to learn things which will be useful to them. When there are no follow-up activities students may develop a negative attitude or at least a neutral attitude toward the use of those kinds of learning activities as they may see little need to pay attention if nothing is done with the information presented.

During the follow-up activities you will be evaluating the accomplishment of the objectives which you have established. If you didn't accomplish your objective you will want to discover why. Such questions as "Was the material appropriate for the objectives, for the background of the students or for the ability of the students?" will help you make this determination. Other questions might be, "Were the students inadequately prepared in terms of interest and motivation?" "How could I have changed the lesson to make it more meaningful?"

If it appears that making effective use of materials is difficult and time consuming, you are beginning to see how demanding teaching is if it is to be done well. Each of the steps in effective utilization are important if maximum benefit is to be received by the student from the use of media. Our goal should always be to use media to assist students to learn effectively and efficiently those things which are important for them to learn. The use of media will be most meaningful if serious consideration is given to selection of the appropriate media for the objectives and the characteristics of the students, preparing ourselves as teachers to present the material in the best possible way, preparing our students so that they may beneficially participate in the learning activity, providing ways for students to be actively involved during the presentation of the material and finally, providing opportunities for students to apply the learning which has taken place to help them learn new things and to do new tasks which are important to them.

Check your understanding of the above material by trying the self-test below.

SELF TEST

Effective Utilization of Media in Instruction

Circle the one most appropriate answer for each question.

1. Effective utilization of media involves consideration of:
   a. Proper selection of media
   b. Preparation of the instructor
   c. Plans for evaluating the use of the media
   d. All of the above

2. When previewing materials to be used you should be concerned about:
   a. Vocabulary used in the material
   b. Physical arrangements required
   c. Follow-up activities
   d. Your ability to operate the equipment

3. Effective utilization can be accomplished if the instructor:
   a. Previews the material
   b. Knows how to correctly operate equipment required
   c. Considers each of the five steps in effective utilization in planning
   d. Helps the students to understand the objectives

4. Selection of materials should be based on:
   a. Its contribution to the accomplishment of lesson objectives
   b. The amount of time required to secure the material
   c. Your ability to operate the equipment required to use the material
   d. None of the above

5. Factors which affect the quality of the learning experience are:
   a. Students learn best when they are actively involved
   b. Students learn best when there is immediate feedback of the consequences of their behavior
   c. Students learn best when the learning activity is perceived to have validity
   d. All of the above

6. Preparation of the instructor would require:
   a. Determining ability level of students
   b. Determining background and experience of students
   c. Planning introduction, presentation and follow-up activities
   d. Determining objectives of the lesson

7. In preparing students for the use of media the instructor should:
   a. Help students to understand the objectives for the material
   b. Explain new or difficult vocabulary
   c. Develop prerequisite skills and knowledge
   d. All of the above

8. Developing student readiness would be the same as the step of:

   a. Teacher preparation
   b. Student preparation
   c. Presenting the material
   d. Selection of the material

9. When presenting or using the material the instructor should:

   a. Go out for a beer
   b. Keep the students actively involved
   c. Help students understand the objectives for the material
   d. Develop prerequisite skills and knowledge

10. The activities appropriate for follow-up activities will be determined by:

    a. Objectives of the lesson
    b. Ability of students
    c. Background of students
    d. Amount of time available after using the material

11. Appropriate, valid follow-up activities help to:

    a. Provide motivation for future use of materials
    b. Develop an understanding and appreciation for the value of media
    c. Accomplish objectives of the lesson
    d. All of the above

12. In presenting material such as film, filmstrip or audio tape the decision to stop and discuss the material during the presentation should be based on:

    a. The length of the material
    b. Your evaluation of the needs of your students
    c. The age of your students
    d. You should never stop during this presentation of these types of materials for discussion, but wait until the program is completed

13. Competency of the instructor in operation of required equipment:

    a. Is not important in the effective utilization of material
    b. Is of great importance in effective utilization of material
    c. Is only important if you are not competent in the subject matter being presented
    d. None of the above

14. The main criteria for evaluating the effectiveness of media material is that:

    a. Students enjoy the learning experience
    b. It is good for teaching
    c. It produces the desired learning
    d. It enhances the image of the teacher

15. Students learn best when:

    a. The learning activity is carefully designed to accomplish clearly conceived objectives
    b. A multi-media approach is used
    c. They are paid for learning
    c. All of the above

16. Follow-up activities should be used to:

    a. Find out what students learned
    b. Find out what students didn't learn
    c. Provide opportunities for students to display knowledge or skills learned
    d. All of the above

17. Previewing materials before using them is important when:

    a. The students have little background in the subject matter area
    b. The teacher has little expertise in the subject matter area
    c. The teacher desires to make the most effective use of the material
    d. Behavioral objectives are not understood by students

18. The attitude that once projected or audio materials are started they should not be interrupted until the end is based on:

    a. Good teaching practices
    b. Tradition
    c. The use of behavioral objectives
    d. All of the above

19. The most effective way to prepare yourself to use a particular material is to:

    a. Talk to someone who has used it before
    b. Read the study guide which accompanies the material
    c. Preview the material
    d. Talk to students who have seen it before

20. Material in which all of the information is not up to date:

    a. Should never be used
    b. Should be used only as a last resort
    c. Should be used if information is appropriate and students are made aware of changes which have occurred
    d. Should only be used if students understand the objectives of the lesson

UNIT EIGHT: USING AND DEVELOPING MEDIA
LESSON 1 of 2

Answers to Self-test

1. --d
2. --a
3. --c
4. --a
5. --d
6. --c
7. --d
8. --b
9. --b
10. --a
11. --d
12. --b
13. --b
14. --c
15. --a
16. --d
17. --c
18. --b
19. --c
20. --c

UNIT EIGHT: USING AND DEVELOPING MEDIA
LESSON 2 of 2: PRODUCTION AND USE OF TRANSPARENCIES ON THE OVERHEAD PROJECTOR

ASSIGNMENT 8.2 PRODUCTION AND USE OF TRANSPARENCIES ON THE OVERHEAD PROJECTOR

Estimated time: Two hours

Although the overhead projector has a great potential for improvement of instruction, this potential can only be realized if the user correctly uses the projector and creates effective transparencies to use on it. This unit will present some suggestions as to how you might make more effective use of the overhead projector and how you can produce attractive and effective transparencies to fit your needs using what will be called "handmade materials". These materials are those which would be easily available and can be used without any special equipment. There are many ways of producing transparencies. These include such methods as the diazo process, thermo process, color lift and photographic transparencies. Each of these has particular advantages and characteristics. However, all require special equipment and in some cases special skills to produce. "Handmade" transparencies are emphasized in this module because you should be able to put this information into immediate use. As part of the unit you will create a transparency using "handmade" materials. If you are interested in learning about other methods of producing transparencies it is suggested that you arrange with a media specialist for an instructional session, contact your media center if you are in a setting where such a service is available or acquire one of the books on this subject listed in the bibliography for this unit.

OBJECTIVES

After completing this unit you should:

1. Describe at least four advantages of the overhead projector over other types of projectors.

2. Describe at least four advantages of transparencies as a medium of instruction.

3. Describe at least four ways or techniques for using the overhead projector which will increase its effectiveness.

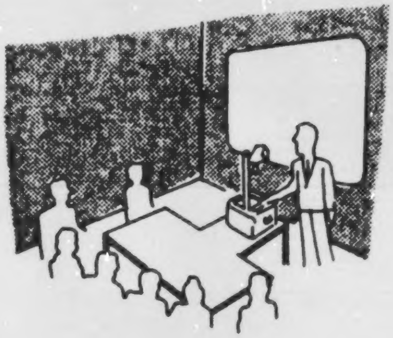
4. Describe three factors which should be considered in creating effective transparencies.

5. Produce a transparency from an original drawing provided using felt or nylon tip pens, grease pencils with transparent or opaque lead, dry transfer letters, transparent color tapes and transparent color adhesive backed acetate sheets.

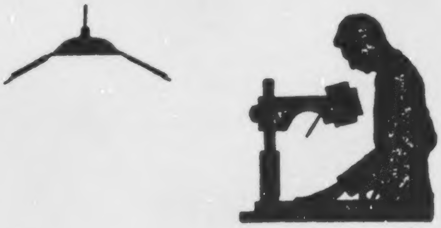
PRODUCTION AND USE OF TRANSPARENCIES ON THE OVERHEAD PROJECTOR

This unit is divided into five areas or topics. These areas are: (1) Advantages of the overhead projector, (2) Advantage of Transparencies as a medium of instruction, (3) Considerations in using the overhead projector, (4) Considerations in planning and producing transparencies, and (5) Producing "handmade" transparencies. After reading through each of these sections proceed with the production of the "handmade" transparency.

ADVANTAGES OF THE OVERHEAD PROJECTOR



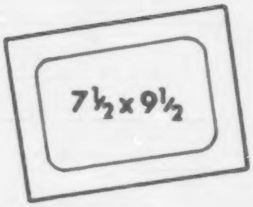
1. Used in front of the group---
   By using the projector in the front of the room the presenter is able to maintain eye contact with the audience. This allows for easy observation of the reaction of the audience and adjustment of the presentation rate or content accordingly. This face-to-face communication possible with the overhead projector is a natural communication position.

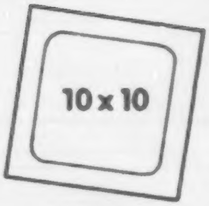


2. Provides a bright image in a normally lighted room---
   This not only eliminates the need for darkening facilities, but makes it possible for easy use of other materials along with transparencies such as models, maps, charts, photographs and demonstrations. This advantage makes meaningful the advantage of being able to face your audience. Students can easily take notes. A lighted room eliminates the drowsiness associated with a darkened room. However, DO NOT hesitate to lower the light level in the room to achieve a more satisfactorily brilliant image on the screen. Some transparencies have a somewhat dense image and the image on the screen can be enhanced in these cases by lowering the light level in the room. You should never have to totally darken the room.

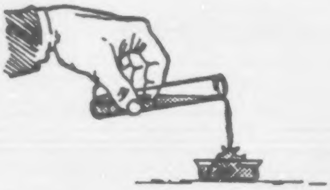
3. Ease of operation---
   The only controls on the overhead projector are the on/off switch, the focusing knob and the elevation control.

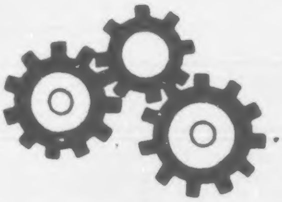
4. Large aperture permits easy use---
   The 7 1/2 x 9 1/2 inch area within a transparency mount or the 10 x 10 inch area of the stage of the projector make it easy to use a variety of materials. Also the large aperture area provides a convenient size for doing the artwork to produce transparencies. It is the large aperture size which permits a very large projected image in a minimum of projection distance. (This is why it can be used in the front of the room.)





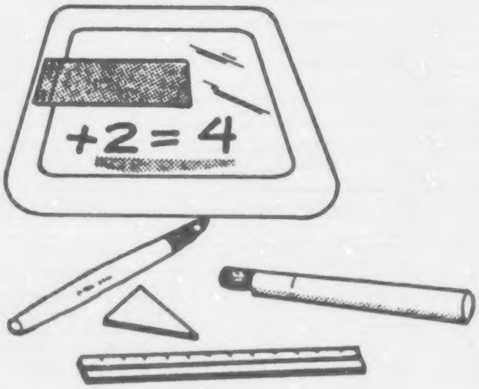
5. Horizontal stage provides flexibility---
   The horizontal stage permits the placement of the opaque, transparent and fluid objects on the stage of the projector. Real objects may be used as well as transparencies. (Unless the objects are transparent a silhouette will appear on the screen.) The horizontal stage also permits the use of such techniques as the use of masks or overlays to provide for progressive disclosure and sequencing of material.

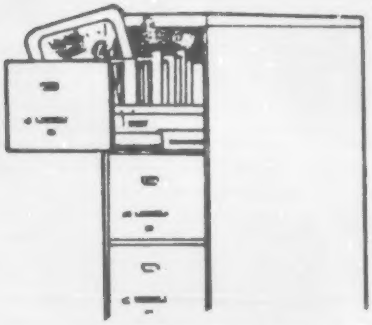




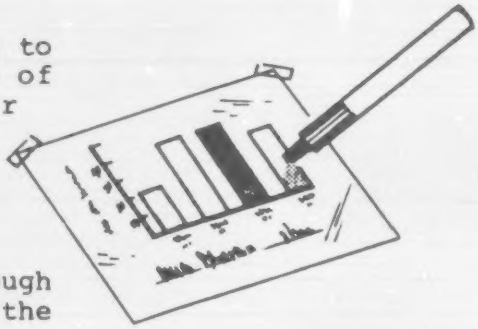
ADVANTAGES OF TRANSPARENCIES

1. Can be locally produced to meet specific needs---
   Transparencies for overhead projection do not require complex equipment or laboratory facilities to produce. Non-professionals can easily prepare simple, but effective visuals in a minimum of time and at low cost using "handmade" materials. There are a variety of techniques for producing transparencies which can be used, each of which has special advantages and characteristics, if the necessary equipment and skilled personnel are available.



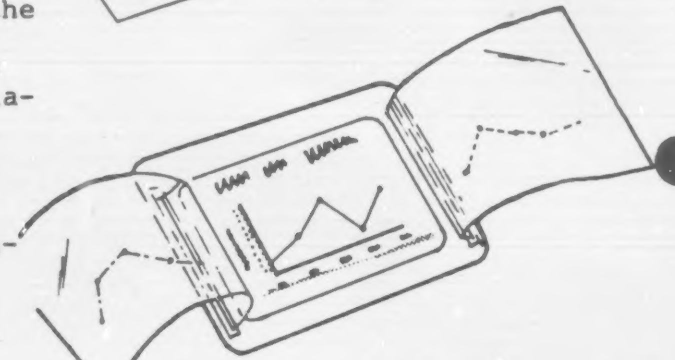


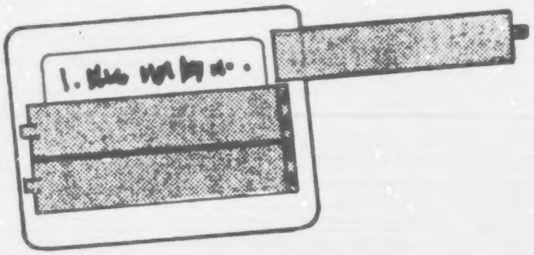
2. Preserved for future use--- Transparencies can be prepared prior to the presentation saving the time used in chalkboard illustrations, providing more time for the presentation. The transparencies can be easily filed for future use saving valuable time where repeated presentations are being made.



3. Inexpensively made in color--- Color can easily be added to transparencies to add emphasis and to separate components. This is true of "handmade" transparencies and other processes such as the diazo and thermo processes.

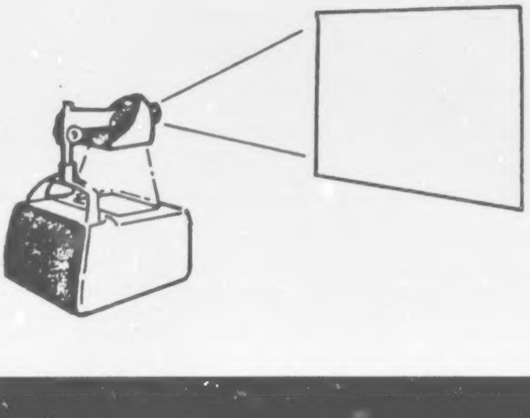
4. Many presentation techniques can be used--- Presentations can be enhanced through the use of disclosure systems and the use of overlays. The presenter by using these methods can control the pace and the content of the presentation when the visual materials are used in combination with verbal explanations. Through the use of polarization techniques motion can be simulated on the screen. Continuous tone photographic images in both black and white and color can be used. Transparent 3-dimensional objects can be used such as a transparent slide rule. Color chemical changes can be projected. Opaque objects can be used when a silhouette is useful in showing the shape of an object. The presentation methods and methods of producing transparencies are limited only by the imagination and skill of the producers.



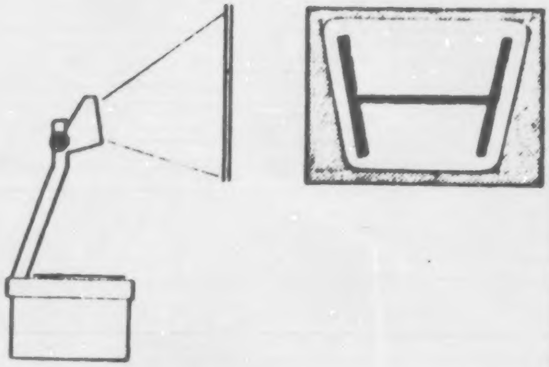


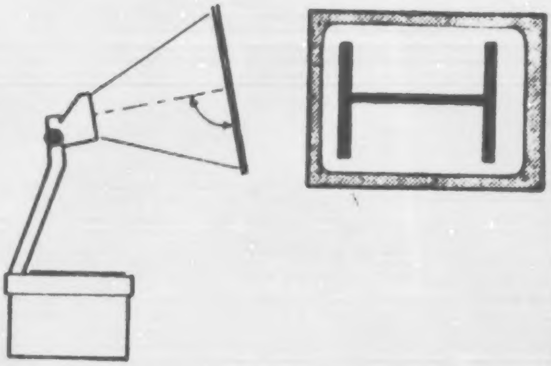
CONSIDERATIONS IN USING THE OVERHEAD PROJECTOR

1. Position the projector so that the projected image is in focus and completely fills the screen. A screen size of at least 70 x 70 inches is recommended to provide for adequate enlargements of the projected image for classroom viewing.



2. Correct any "keystoning" by adjusting the screen angle. Keystoning is the distortion of the image so that it is wider at the top caused by increasing the height of the screen image without changing the angle of the screen so that the light from the projector strikes the screen at 90°. When using a tripod screen with a keystone elimination rod this correction is accomplished by slanting the top of the screen toward the projector. When using a wall screen which is mounted away from the wall with keystone elimination brackets the correction is made by pulling the bottom of the screen toward the wall. If the keystoning is not eliminated part of the image may remain out of focus because of the differences in the distance from the lens of the top of the image and the bottom of the image.

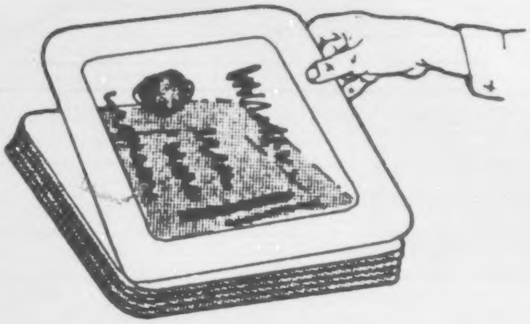




3. Check the classroom seating arrangement to see that no student must "look around" or "through" the projector or you to see the screen. Student viewing may be improved by using a tripod screen in the corner of the room or mounting the screen permanently in the corner of the room. If this is not possible the screen should be located high enough to eliminate any obstruction of the view of the screen. Placing the projector on a low stand and sitting next to it will allow for good viewing when using a wall screen in the front and center of the room.

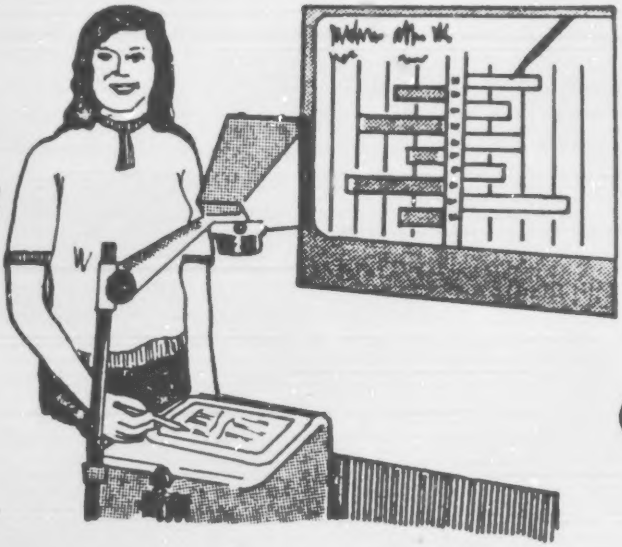
4. Stay seated next to the projector if possible. Standing beside the projector or walking back and forth in front of the screen is distracting to the audience.

5. Arrange your transparencies beforehand so as to permit an orderly flow to your presentation.



6. Stack your transparencies neatly as they are removed from the projector to maintain the established sequence. This will allow you to find a transparency quickly when needed for review.

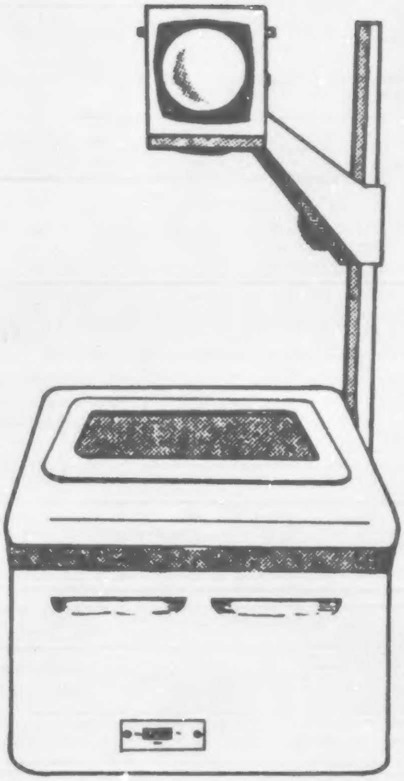
7. Have an overhead projector pointer ready for use on the transparency to draw attention to a particular item or portion on the transparency. A common pencil or pen will serve this purpose. Touch the pointer to the transparency to prevent movement. Your finger can be used as a pointer. However, it is possible when using your finger, that the rest of your hand may cover part of the transparency. Never go to the screen to identify a part of the projected image. Use your pointer on the transparency.



8. Use the overlay and progressive disclosure techniques to control the sequence and content of the material on the screen. These techniques will keep the attention of the audience focused on the important elements of the presentation.

9. Position the transparency before turning on the projection lamp. It is distracting to see the image on the screen not lined up correctly and also to see the positioning of the transparency after the lamp is turned on. Do not turn from your audience to check the image on the screen. Remember, one of the advantages of this projector is that you can maintain eye contact with your audience. You will see the exact image being projected by looking at the transparency--there should be no need to look at the screen if you have lined up the projector and transparency correctly.

10. When you are ready to change transparencies turn the lamp off before removing the transparency. Position the next transparency on the stage of the projector and then turn the lamp back on. A bright white screen only competes for attention. When you turn the lamp off the audience immediately shifts its attention back to you. If you leave the lamp on when there is no transparency on the projector, the screen continues to compete with you for attention.

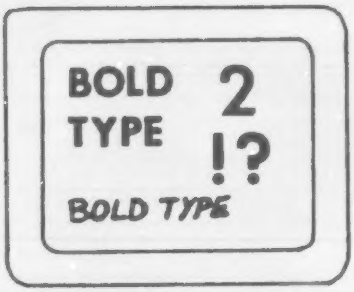


11. Never leave a transparency on the screen that is not related to the subject being presented. When the subject changes either change the transparency or turn off the lamp. Both the unrelated transparency and the blank lighted screen compete for attention with you as previously noted. Turn on the lamp only when the image on the screen is relevant to the topic being considered and that is when you want the attention of the audience. Turn off the lamp when you want the attention of the audience focused on you. The overhead projector should be employed only to emphasize, amplify and clarify what you are trying to communicate.

CONSIDERATIONS IN PRODUCING TRANSPARENCIES

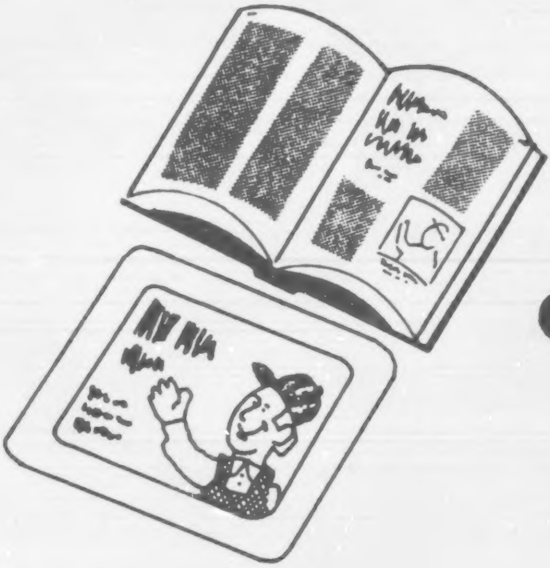
1. Transparencies should not replace or duplicate hand-out materials although a transparency might be reproduced as a handout. Transparencies should be used to emphasize main points. Perhaps the greatest misuse of transparencies is to place too much information on a single transparency. Materials which require extensive writing do not make good transparencies and should probably be produced as a handout. I'm sure you have experienced transparencies of a typed or printed page which was too small for you to read and required the presenter to read the information to you. One main idea or point should be presented at a time. Too much information,

whether written or illustrated on a transparency, may cause confusion on the part of the audience. Only the essential information should be used.



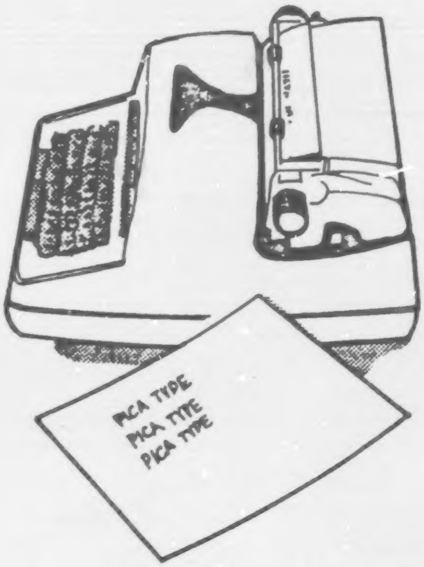
2. Use bold letters, numbers or symbols on transparencies. Boldness adds significantly to the visual impact.

3. When using illustrations from books for transparencies the material should be enlarged, by the use of a pantograph, opaque projector or enlargement camera to fit an approximate area of 7 1/2 x 9 1/2 inches. All of the unimportant details should be left out. Copying or tracing printed materials directly from books is a poor practice because the drawings are too small and generally too complicated to make good transparencies. Illustrations in books are meant to be studied closely and on the basis of one student to one book and size is of little importance in this situation.

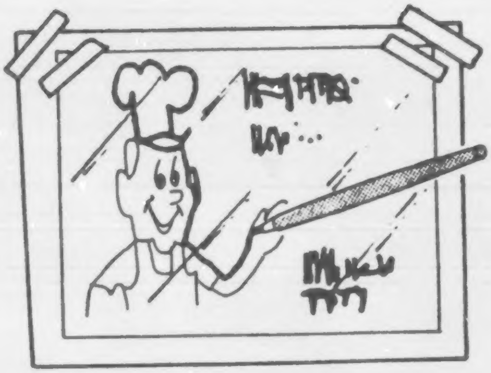


4. Add interest to your transparencies by using several different types of material on your "handmade" transparencies, having a clear center of interest and by the imaginative use of color.

5. If a typewriter is to be used in lettering a transparency use a primary typewriter or a typewriter with similar size type. Elite or pica type is too small to be easily read. If a primary typewriter is not available, it is recommended that hand lettering or some type of lettering device be used such as dry transfer letters if the audience is to be able to easily read the material. It is always easy for you to read the material as you look at it in the stage of the projector. Look at the material on the screen from where your audience is sitting to determine the suitability of the size of lettering.



6. When producing a handmade transparency sketch the entire plan for the transparency on a piece of paper within a 7 1/2 x 9 1/2 inch area; the area within a transparency frame or mount. After you have completed your sketch, place a piece of acetate over the top of the drawing and trace the material onto the acetate using felt or nylon tip pens or grease pencils and complete the lettering of the transparency.

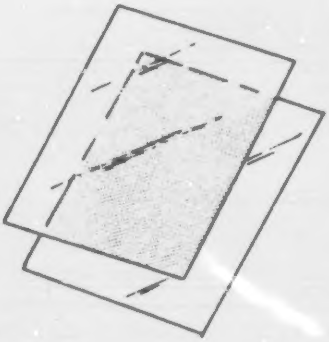


7. When possible use a horizontal format in planning, designing and producing transparencies. This practice, although not always possible, provides for using the most easily seen part of the screen (the top) when the transparency is projected. If necessary re-arrange the material on the original you are going to reproduce to make it fit the horizontal format.

MATERIALS FOR PRODUCING HANDMADE TRANSPARENCIES

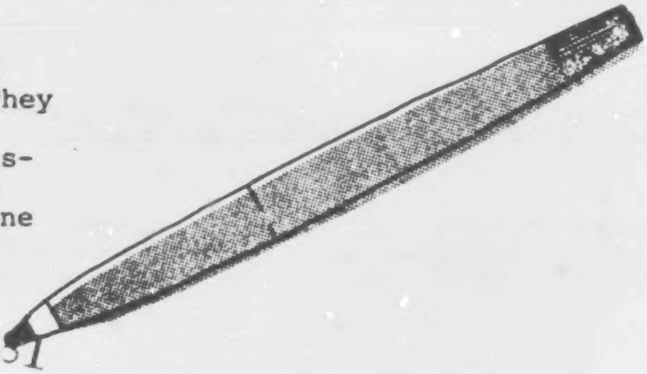
Clear Acetate Sheets

These acetate sheets are used as the base for "handmade" transparencies. The other materials listed in this section are used on these acetate sheets. These sheets can also be used to protect the surface of a "handmade" transparency by covering the surface with a piece of acetate. This allows you to write on the transparency while using it without damaging the original transparency. Reprocessed X-ray film works well and is inexpensive. A source for reprocessed X-ray film is listed on the materials sheet included in this unit.



Felt and Nylon Tip Pens or Markers

These pens or markers are applied directly to the acetate sheet. They are useful for coloring in small areas. Since the colors are transparent apply them carefully; each overlapping stroke deepens the tone and may produce uneven tones in large areas. Nylon tip pens have



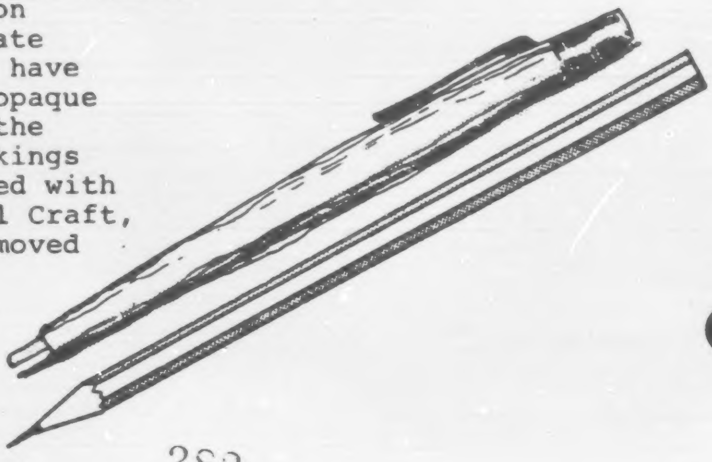
fine tapered points and are most useful in drawing lines and writing. Felt tip pens usually have a broad tip and are most useful for coloring areas.

All felt or nylon tip pens do not project color equally well when used on acetate. The colors may look very bright, but when projected may look very dark or even a different color. The ink from some pens tends to bead up and disappear. You should test a particular brand of pen before purchasing it for use on the overhead projector.

There are two basic types of pens--Permanent and Non-Permanent. Permanent pens use a spirit based ink which cannot be removed from acetate except with cleaners such as spirit duplicating fluid or lighter fluid. If in doubt as to whether the ink is permanent, make a small mark on a piece of acetate, dampen your finger and rub the line. If it does not smudge or wipe off, it is permanent. Non-permanent pens use a water based ink which can be easily removed from acetate with a damp cloth. Transparencies made with non-permanent pens should be covered with a clean sheet of acetate to prevent the smudging of the colors should your moist hand come in contact with the ink while using the transparency.

Grease or Wax Pencils (China Marking Pencils)

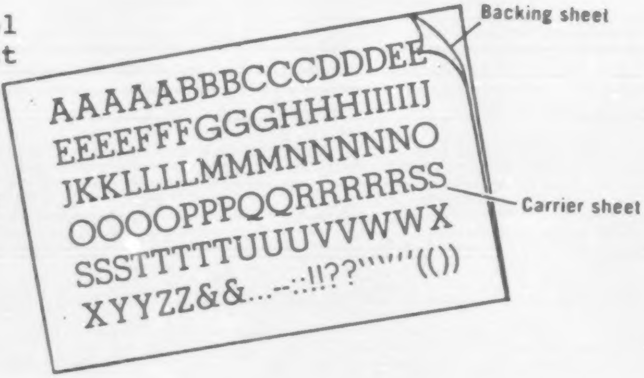
Grease or wax pencils are common types of material used on acetate sheets. Most of these pencils have a grease or wax base which is opaque and projects a black image on the screen. The grease or wax markings on a transparency can be removed with a dry cloth. One brand, Visual Craft, is water-soluble and can be removed with a damp cloth.



There are several different types of special pencils which are available which have grease or wax base which is translucent and can be used to project color when used on clear acetate sheets. The brilliancy of the color projected on the screen varies with the degree of transparentness of the grease or wax lead in the pencil and the amount (intensity) of the light on the screen. How heavy you draw your lines can also affect the brilliancy of the image. Because the substance in these pencils will smudge, it is recommended that the acetate sheet on which they are used be covered with a second sheet if it is to be stored for future use.

Dry Transfer (Rub on) Letters

The dry transfer process allows a pre-printed letter, number of symbol to be transferred from a transparent or translucent carrier to any dry surface by rubbing the image down with a pencil, ball point pen or burnishing tool. The letters, numbers and symbols come in various sizes and styles. They are available in transparent colors for direct use on transparencies. A professional touch can be added to "handmade" transparencies using these materials.



Procedure for applying dry transfer letters:

1. Remove the backing sheet from the letters.

2. Position the letters on the surface, spacing the letters optically, so they appear properly spaced based on the space requirements of individual letters.

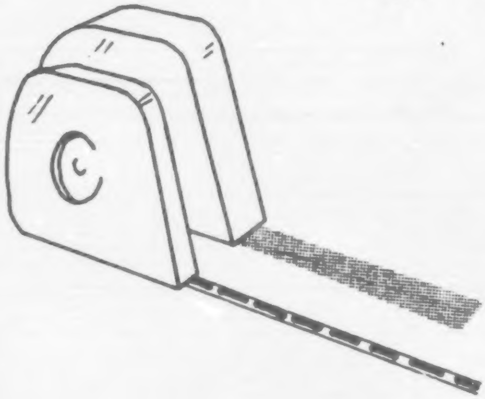
3. Burnish (rub) the entire letter to the mounting surface with a blunt instrument such as a ball point pen, pencil or burnishing tool. Be sure you rub the entire surface of the letter or number. If you make a mistake the letter can be removed by sticking a piece of masking tape on the letter and removing the letter.

4. Slowly pull the sheet of letters from the mounting surface. The letter will remain transferred.

5. After all letters have been transferred, replace the backing sheet behind the letter sheet.

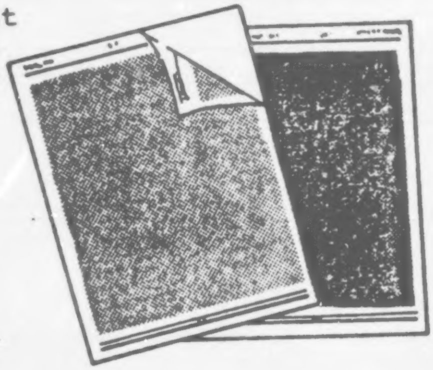
Transparent Tapes

Transparent color adhesive backed tapes are available in a variety of colors, black and white patterns, and in various widths. They come in easy to use dispensers and can be applied directly to the surface of acetate sheets. These tapes project a very vivid color. To apply to acetate lay the strip of tape onto the sheet of acetate leaving the tape a little longer than desired, and then trim to the desired length with an x-acto knife or razor blade. Be careful when cutting the tape to avoid cutting the acetate sheet as these cut marks will show up as dark lines on the screen.



Color, Adhesive-backed Acetate Sheets

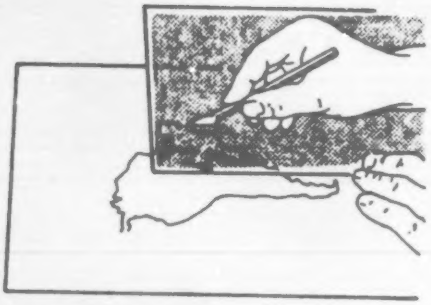
These sheets come in a wide range of colors and patterns, both translucent and transparent. They are excellent for use on areas of any size and are applied directly to the acetate sheet. The brilliancy of the color projected on the screen will vary with the transparentness of the particular brand color sheet used. Those materials designed for use on transparencies will project a brilliant color.



Procedure for Applying Color Adhesive Acetate:

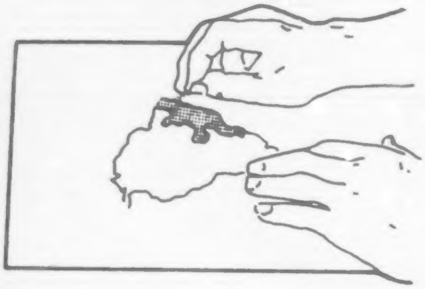
1. Place a sheet of the selected material over the area of the transparency to be colored or shaded.

2. Lightly (carefully) cut a piece slightly larger than the area to be colored or shaded. Try not to cut through the backing sheet.



3. Peel the cut piece from the backing sheet.

4. Place the cut piece of adhesive backed material over the area to be covered and rub to adhere. Ease the colored piece into position smoothing by hand so that there are no air bubbles or wrinkles. Place the color piece on the underside of the transparency so that it cannot be damaged during use or cover the transparency with a second piece of acetate if the material is placed on the top of the transparency.



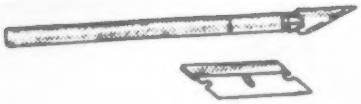
5. Trim the color material to match the area using lines on the diagram as guidelines. Use care when trimming the material so as to not cut through the acetate as the cut will show up as a dark line when projected.

Transparency Mounting Frames

These frames make it easier to handle and file transparencies as information related to the transparency can be written on the frame. When using overlays or disc-osure masks, these are taped to the top of the mounting frame.

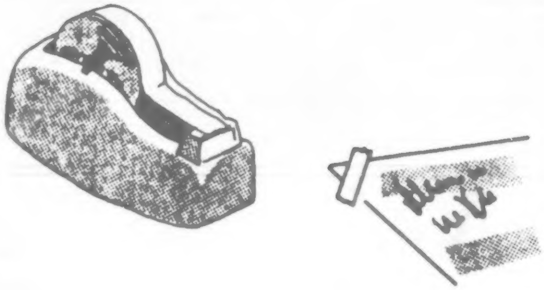
X-Acto Knife or Razor Blade

Some type of cutting instrument such as an X-acto knife or razor blade is needed to cut transparent tapes and color adhesive acetate sheets.



Masking Tape

Masking tape is useful to tape the acetate sheet to the drawing to be traced and to attach the transparency to a mounting frame if one is used. If a mounting frame is used place the transparency on the bottom of the frame and tape it down to the frame with masking tape. Masking tape can also be used to tape selection disclosure masks and overlays to the top of the mounting frame.



Complete exercise on following page

Producing a Transparency Using Hand-Made Material

To complete this part of the unit you will need the materials which have been identified for producing "handmade" transparencies. When you have the materials available you should proceed as follows:

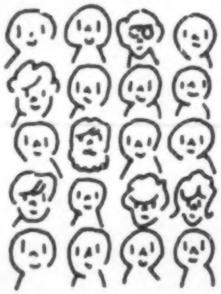
1. Using masking tape fasten the acetate sheet to the transparency original which is provided.
2. Using the material required in the transparency original draw, letter or color in the areas of the transparency.
3. Cover the transparency with an acetate sheet and mount on the bottom of a transparency mounting frame (if available).
4. Prepare a set of transparencies which could be used to present the eleven points covered in the section of this assignment titled "Considerations in Using the Overhead Projector". Use the materials available for this lesson as well as any others to which you may have immediate access. You should create at least three transparencies. Your instructor will be available for guidance and to examine your work.

(Transparency Original)

TODAY'S TRENDS

More
CITY
LIVING

More
PEOPLE



More
**TECH-
NOLOGY**

lead to
CONTAMINATING

OUR AIR

OUR LAND

OUR FOOD

OUR WATER

PRODUCING TRANSPARENCIES FOR THE OVERHEAD PROJECTOR

(Check with your local audio-visual dealer for these supplies)

I. Ready to use materials

  A. Clear acetate (roll or sheet) re-processed x-ray film

    1. Grease pencils
      a. Opaque - remove with dry cloth (several on the market for use on the overhead are water soluble)
      b. Transparent - Mars Lumo color - remove with dry cloth
      c. Can be used on prepared transparencies

    2. Felt or nylon tipped pens
      a. Permanent
      b. Water soluble
      c. Not all pens are equally transparent - try them before you buy them

    3. Adhesive acetate sheets
      a. Good for coloring in large areas
      b. Variety of colors and patterns available

    4. Lettering - Dry transfer
      a. Available in various colors, sizes and styles

    5. Transparent tapes
      a. Available in various colors and patterns

  B. Frosted Acetate - translucent

    1. Lumochrom pencils (transparent lead)
    2. Ordinary lead pencil
    3. Felt or nylon tipped pens
    4. A-3, 4, 5 above can also be used

  To make clear (transparent), spray with clear plastic spray. All materials become permanent after spraying.

  Advantage - works well for fine lined work

II. Semi-ready to use materials

  A. Spirit duplicator transparencies

    1. Made with frosted acetate sheets
      a. Run through spirit duplicator so that frosted side comes in contact with spirit master carbon

2. Adding color
    a. Use various colored carbons
    b. Lumochrom pencils
    c. Felt or nylon tipped pens
    d. Adhesive acetate

3. Spray with clear plastic spray to make transparent and permanent

B. Lifted pictures - Pictures must be printed on clay coated paper

1. Can be done using any laminating machine
    a. Dry mount press
    b. Thermofax (heat)
    c. Translifter (cold)
    d. General binding laminator (heat)
    e. Rubber cement method

2. Apply laminating material to surface of picture

3. Soak in detergent solution

4. Remove paper from back of picture (ink left on acetate)

5. Either spray back with clear plastic or apply a second sheet of laminating material (depends on process used)

Note: By applying laminating material to both sides of a picture of which you wish to save the picture on both sides, you can lift both pictures at the same time.

III. Process requiring special equipment

A. Heat or thermo process

1. Material which is to be copied must be printed in a lead or carbon based ink - (not ball point unless pen is specifically designed for this purpose)

2. Wide variety of different types of material
    a. Clear with black image
    b. Clear with white image (Projects black)
    c. Tinted with black image (red, green, blue or yellow background)
    d. Negative image (red, green, white, blue and yellow on black background)

3. Felt or nylon tipped pens, grease pencils and pieces of colored acetate can be used on these transparencies
    a. Advantage - quick and dry
    b. Disadvantage - original must be printed in right kind of ink

B. Photo Copy

  1. Use Xerox, 3M or other dry photo copies

  2. Advantage - original copy can be printed in any kind of color or ink

  3. Disadvantage - most copiers do not reproduce half tones well - some machines do better than others

C. Photographic Process - Photographic enlargement

  1. Made from black and white negative

  2. Using enlarger, enlarge negative onto either Kodalith Ortho film or fine grain positive film

  3. Develop according to directions

  4. Advantage - will reproduce continuous tone

  5. Disadvantage - requires photographic darkroom and darkroom equipment and trained darkroom personnel

IV. Mounting Transparencies

A. Any kind of cardboard frame can be used

  1. Commercially made frames available

B. Mount single transparency on bottom of mount

C. For transparency with overlays, mount basic transparency on bottom of mount and hinge overlays on top of mount

D. Mounting overlays

  1. Masking tape or mylar hinges

  2. Sequence of mounting overlays
    a. Dependent on desired order of presentation and flexibility

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT NINE
ADAPTIVE INSTRUCTION

Estimated time for unit - Two hours

The CONTENT of this unit:

Adaptive instructional methods permit the modification of instruction to meet the needs of individual trainees and small groups. Methods such as tutorials, individual and small-group assignments (including readings, exercises, role-plays, and simulation exercises), and individualized learning packages permit the adaptation of instruction by such means as varying time on task, number and/or level of complexity of learning activities, degree of instructor control and guidance, and circumstances of use (classroom, on-the-job, or take-home). This unit introduces participants to three basic types of adaptive instruction -- tutorials, individual assignments, and individualized learning packages -- and provides guidelines for creating or selecting and using these methods.

The OBJECTIVES of this unit:

By the end of this unit, you will be able to:

-define "adaptive instruction" and list at least three characteristics which differentiate adaptive instructional methods from other instructional methods
-name three types of individual assignments and list the central characteristics and utilization criteria for each
-explain what an Individualized Learning Package is and what it should contain
-list the criteria for selection or creation of adaptive instructional materials

The PURPOSE of this unit:

This unit is designed to teach participants how to identify adaptive instruction needs, to select or create relevant types of adaptive instruction, and to use these methods appropriately. The unit presents characteristics of and guidelines for utilizing adaptive methods of instruction.

The RESOURCE for this unit:

Content Summary

UNIT NINE: ADAPTIVE INSTRUCTION
CONTENT SUMMARY

I. Adaptive Instruction Defined

Instruction that meets any or all of the following:

-focuses on participative learner activities
-is adapted or modified to meet needs of individual learners or small groups of learners
-involves the instructor in guidance or supervisory activities rather than teaching (i.e., content-presentation) activities
-allows for variation in : time on task;
number of practice activities required;
complexity or level of difficulty of practice activities;
amount of instructor guidance or supervision;
location for use (classroom, OJT, at-home).

II. Types of Adaptive Instruction

A. Individual Assignments: part of instruction in which the active performer is the learner; contained within a lesson but does not constitute the entire lesson; participative learner activity which is responsive to an instructional objective; under direct control of learner.

1. Content Presentation - readings, audiotaped lectures, video presentations, audio-visual presentations. Learner control through ability to attend to presentation on own time, to control rate of presentation by selectively replaying sections at will (variable-speed playback capacities), to freeze, replay, or fast-play video presentations, to skim or reread print materials.

2. Exercises (practice activities): activities requiring learner to respond to content in some way, to use what is being learned -- requires trainees to write, speak, or do something.

Examples: exercises in labeling the parts of a diagram, carrying out a procedure, using a concept definition, using a formula to calculate the weight of a sample, and troubleshooting on a malfunctioning piece of equipment.

3. Role-plays, Simulations and Games: activities in which learners simulate some event, confrontation, or situation in order to gain experience and insight in dealing with such events. Equipment mock-ups, artificially represented situations, and scenarios are used to provide practice when actual equipment or real-life events and situations cannot conveniently be employed.

B. Individualized Learning Packages (ILPs): completely self-contained instructional materials which can be used by an individual learner without direct instructor control. Instead, an instructor or supervisor is needed to manage the access to materials and keep records. Packages can be commercially/professionally prepared or instructor-created.

C. Tutorial: one-to-one instructional situation which focuses on identifying and solving a learning problem. The tutor may be either the instructor or a fellow trainee.

III. Criteria for Selecting Types of Adaptive Instruction

A. What is the need?

-Do different trainees within a class work at different rates?
-Do only one or two trainees require training at any given time?
-Do trainees need "real" experiences with situations and events that cannot be forced to occur on demand?

B. What is the instructional objective?

-Can the instructional objective be achieved by adaptive instruction?
-If so, which type is most appropriate to the objective?

C. What instructional materials are readily available or are easily produced or obtained? At what cost (price or production time/resources)?

D. What are the trainees' preferred learning modes?

ADVANCED INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT TEN
MANAGEMENT OF INSTRUCTION

Estimated time for unit - Two hours ten minutes

The CONTENT of this unit:

This unit consists of three lessons each dealing with the management of particular kinds of instructional situations: formal-classroom instruction, on-the-job or near-site training, and workshops. Each lesson deals with materials particularly important to the conduct of that kind of instructional activity, but they also contain suggestions and considerations relevant across all three situations. The main focus of the lesson on classroom management is the control of the physical and psychological environment of the instructional situation. The lesson on training in a work environment highlights techniques, advantages and disadvantages of on- or near-site training. Finally, the lesson on planning workshops details the kinds of specific logistical preparations that may have to be completed in advance of an instructional activity.

The OBJECTIVES of this unit:

As a result of this unit's instruction you will be able to:
- identify important variables in the physical and interpersonal environment of the classroom and describe examples of techniques for classroom management and maintaining trainee attention.
- describe techniques and characteristics of effective training in the work environment.
- describe administrative and logistical considerations involved in planning and conducting a workshop.

The PURPOSE of this unit:

The delivery of effective instruction involves more than well-designed materials. Attention must also be given to a variety of variables affecting the delivery of those materials in specific situations. This unit addresses the most important considerations in the delivery of classroom instruction, on-the-job training, and workshops.

The RESOURCES for this unit:

1. Content Summary
2. Workshop Check List

UNIT TEN: MANAGEMENT OF INSTRUCTION
CONTENT SUMMARY

Classroom Management

There are two major kinds of environmental influences on the effectiveness of instructional communication:

1. physical environment - the setting for the instruction
2. psychological environment - the learner's attitudes and dispositions towards the instruction or the setting

Considerations when planning instruction include:

-selection of methods and media
-rewards
-class schedule
-degree of formality

Techniques for managing class and maintaining attention include:

-beginning with overview
-noting progress
-directing attention
-maintaining participation
-maintaining appropriate pace and variety
-moving around classroom
-counseling problem students
-treating all students equally

Training in a Work Environment

Whether the instructor is in-house or from an outside group, all roles should be clearly defined. Some questions to be resolved are:

1. What is the role of the instructor in relation to that of the plant supervisor? Is the trainee a supervisor?
2. Is the instructor from a regulatory agency? Do the personnel feel "threatened"?
3. What is the instructor permitted to do with or to equipment at the plant?
4. Who is responsible if equipment is damaged or an accident occurs?
5. Can the instructor and the trainee(s) devote the total allotted time to instructional activities?

When choosing a site to conduct training for employees from more than one plant in an area:

1. Provide an environment where the trainees can feel comfortable and can learn. Avoid schools. Look for community centers like a city hall, fire house, etc., with restaurants nearby.
2. Choose a plant utilizing processes most common in the area. The plant should be reasonably near the instructional center.
3. The instructor must be familiar with the specific equipment at the plant so he can explain or demonstrate it.

Preparing for Instruction:

1. Prepare and use a thorough check list for all instructional materials and audiovisual equipment including extension cords, extra bulbs, etc., since these are not ordinarily available.
2. All preparations must be done in advance because resources will not be available.
3. Contingency plans are especially important. For example, have an alternate "classroom" presentation ready in case rain prevents use of plant facilities. Have a pertinent audiovisual ready to show if a speaker is called out for some emergency.
4. Arrive early enough to:

   -Make personal contacts.
   -Check out plant equipment if it is involved in the instruction.
      -Set up and check out projection equipment, etc.
      -Set up any demonstration equipment.
      -Organize instructional materials.
      -Plan or arrange facilities with regard to seeing, hearing, and minimizing distractions.
   -Arrange for carrying out contingency plans in case equipment malfunctions, etc.

Planning and Conducting Workshops

(See attached check list)

WORKSHOP CHECK LIST

The following checklist is designed to facilitate the control of key administrative and logistical considerations in planning and conducting workshops.

All of the points will not be relevant to every workshop. Use the left-hand column to check those points which do apply to the workshop under consideration. Establish a deadline for the completion of each point/task and write the date in the space provided. Finally, use the righthand column to check off each task as it is completed.

(Note: This checklist does not consider the design of the workshop's instructional content as these activities are presumed to proceed separately following the steps of the instructional design model presented in Unit One.)

☐ Applicable Completed ☐

Administrative Considerations

☐ Workshop staff identified (Director/Chair, Trainer, Audio-Visual Specialist, Other) *Deadline* ______________ ☐

☐ Budget established (Salaries/honorariums, consultants, media production, equipment and facilities rental, transportation, participant costs, duplication and telephone) *Deadline* ______________ ☐

☐ Production resources identified and availability determined (for signs, manuals, programs, etc) *Deadline* ______________ ☐

Technical Planning and Operations

☐ Target audience identified *Deadline* ______________ ☐

☐ Workshop date or dates determined *Deadline* ______________ ☐

☐ Overall timelines for workshop preparation established *Deadline* ______________ ☐

☐ Means of contacting target audience determined *Deadline* ______________ ☐

☐ Target audience contacted *Deadline* ______________ ☐

☐ Workshop's objectives defined *Deadline* ______________ ☐

☐ Agenda established *Deadline* ______________ ☐

☐ First draft of training materials/presentations *Deadline* ______________ ☐

☐ Field test of workshop materials *Deadline* ______________ ☐

☐ Meeting rooms and other facilities located and reserved (see below) Deadline ________________ ☐

☐ Revised workshop materials Deadline ________________ ☐

☐ Materials reproduced in final form for workshop Deadline ________________ ☐

☐ Travel arrangements completed Deadline ________________ ☐

Facilities Arrangements

☐ Meeting room arranged as desired Deadline ________________ ☐

☐ Provision for room darkening available Deadline ________________ ☐

☐ Room clean, furniture suitable, lighting/air conditioning working properly Deadline ________________ ☐

☐ Public address system available and working Deadline ________________ ☐

☐ Water glasses/pitchers available for speakers and participants Deadline ________________ ☐

☐ Ashtrays available and/or local smoking regulations determined Deadline ________________ ☐

☐ Chalkboard, easels, screens, pointers available for presentations as required Deadline ________________ ☐

☐ Pencils, note paper available for participants Deadline ________________ ☐

☐ Arrangements made for coffee breaks/lunch Deadline ________________ ☐

☐ Arrangements for participant registration complete Deadline ________________ ☐

Audio-Visual Preparations

☐ Necessary projection equipment of suitable size and type available/ordered Deadline ________________ ☐

☐ Projectionist scheduled for each session Deadline ________________ ☐

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☐ Public address system tested and volume levels set Deadline ________________ ☐

☐ Projection equipment tested in the meeting room using actual materials Deadline ________________ ☐

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☐ Copies of all print and audio-visual materials delivered to workshop site Deadline ________________ ☐

PLANNING FORMS AND WORKSHEETS

PROBLEM DEFINITION WORKSHEET

(1) Something has caused you to suspect a personnel performance problem. What is it? Describe the problem briefly in the space below.

(2) Identify the specific employees by job or position title (not name) that are involved in or affected by the problem described above.

(3) What are the characteristics of this problem? Check as many of the following items as seem relevant.

A

___new people have been hired

___experienced people have new tasks or responsibilities

___new equipment, facilities or technology is being used

___new information exists

___output of work is low

___people cannot perform a task effectively

___people do not know how to perform a task

B

___undesirable attitudes toward work are present

___people do not seem to want to work

___there are no rewards for doing well

___employees provide poor service

___people feel that getting job done is not worth the effort

___employees rarely receive feedback on their performance

___employees are punished for poor performance

C

___everything takes too long

___there is not enough time to do the work

___equipment frequently does not work or breaks down often

___supplies sometimes run out

___new management or management policy exists

___employees rarely talk to their superiors

___weak or inefficient management is apparent

___people frequently seem to have nothing to do

(4) In which of the columns (Step 3) are most of the items you checked located?

____A? ____B? ____C?

If A, you appear to have a problem where employees lack skill or knowledge.

If B, the immediate indications are that there is a motivation or incentive problem.

If C, it is likely that you are faced with an environmental problem. (Something in the work setting is preventing people from performing effectively.)

(5) At this point, it is helpful to summarize the information gained in the previous steps. You should now be able to describe your problem in terms of WHO is affected (Step 2), WHAT is involved (Step 3), and WHY (Step 4). (You may also want to gather some further information about the specific nature of the problem at this point in order to develop more specific answers to the WHO, WHAT, and WHY questions.)

Write a clear summary of the problem in the following format:

WHO

WHAT

WHY

(If a variety of different jobs are affected by or involved in this problem, it may be useful to construct separate problem statements for each.)

(6) Is a training program a relevant solution to the specific problem defined above? Consider the following points as appropriate to the identified cause of the problem (Step 4).

-If you identified your problem as involving an employee lack of skill or knowledge, you may want to consider a training program.

-If you decided that you have a motivation or incentive problem, you may want to discuss the situation with others to insure that this problem lends itself to a training solution. (Many times a change in organizational policy or management procedures is a more effective solution.)

-If the problem seems to involve something in the work environment, it is rather unlikely that a training program is a relevant solution. (Investigate the situation further and consider direct changes in the work setting.)

Does a training program represent a relevant solution to your problem?

____ Yes ____ No

What other kinds of actions might be taken to address the problem in combination with or instead of a training program?

Additional strategies:

(7) If you are still certain that some form of training program is called for, proceed to analyze the training need for such a program using the Job Task Summary Sheet. Separate Job Task Summary Sheets must be completed for each job to be the subject of training.

TASK DETAILING SHEET

A. Write Job Title ____________________

B. Write Task ____________________

Complete steps C - F in the space below.

C. List the specific steps required to perform the task.
D. Check each step which needs to be taught.
E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.
F. For a cognitive behavior, indicate the appropriate level of performance:
    Knowledge - ability to recall information or procedures
    Comprehension - ability to explain information or procedures
    Application - ability to use information or procedures to do something
    Problem Solving - ability to develop new information or procedures

C Steps Required to Perform Task	D Needs to be Taught	E Type of Behavior: Cognitive, Affective, Psychomotor	F Level of Cognitive Behavior: Know., Comp., Appl., P. S.
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			
(9)			
(10)			
(11)			
(12)			

LESSON PLANNING FORM

Job Title ______________________________ Task ______________________

Step ______________________

Type and Level of Behavior ____
(as appropriate)

1) Instructional Objective:

Audience ____

Behavior ____

____

Conditions ____

____

Acceptable Performance ____

____

2) Entering Competencies: ____

____

3) Evaluation Activities: ____

____

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s) ____

____

____

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1. ____
2. ____
3. ____

JOB TASK SUMMARY SHEET

A. Job Title ____________________

1. Describe the job in terms of its major duties (2-4) of responsibility.

A) ____________________
B) ____________________
C) ____________________
D) ____________________

2. Which duties are most relevant to the problem identified in the Problem Definition Worksheet? Circle the relevant items on the list above.

B. For each duty chosen as relevant to the identified problem, prepare a list of the specific tasks which make up the activities of that duty. (Use additional pages if necessary to describe other duties/tasks.)

DUTY ____________________
TASKS 1) ____________________
2) ____________________
3) ____________________
4) ____________________
5) ____________________
6) ____________________
7) ____________________

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TASKS 1) ____________________
2) ____________________
3) ____________________
4) ____________________
5) ____________________
6) ____________________
7) ____________________

C. Should all of the tasks under each duty be considered as subjects for training programs? Circle all the tasks which require training attention, given your definition of the problem. (In deciding whether a specific task should be the subject of a training program, consider its relative importance, frequency of performance, and overall difficulty.)

D. Complete a Task Detailing Sheet for each task to be considered as the focus of a training activity.

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

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This chart will help you to plan your lesson. Fill in each column for each activity included in the lesson.

Objective: ______________________________

____

____

Type and Level of Behavior: ______________________________

Step/Activity	Method(s)	Media	Strategies
1.			
2.			
3.			
4.			
5.			
6.			

INSTRUCTIONAL METHODS SELECTION TABLE

Instructional Method Types of Behavior	LECTURE	DEMONSTRATION	GUIDED DISCUSSION	ADAPTIVE INSTRUCTION*
COGNITIVE, Knowledge	Appropriate for teaching facts	Generally not useful	Generally not useful	Useful and appropriate for conveying factual information
COGNITIVE, Comprehension	Appropriate	Useful as a supportive method to reinforce concept-using	Generally not useful	Appropriate
COGNITIVE, Application	Appropriate for initial presentation of rules	Most appropriate method for teaching rule-using	Generally not useful	Appropriate for initial presentation of rules
COGNITIVE, Problem-Solving	Generally not useful	Useful for problem-solving instruction	Useful and appropriate for developing problem-solving skills	Exercises are useful for teaching problem-solving
PSYCHOMOTOR	Useful only in support of a demonstration	Live or simulated demonstrations are the most effective method for teaching motor skills	Generally not useful	Useful only in support of a demonstration
AFFECTIVE	Usually not effective for motivating trainees or changing attitudes about something	Modelling and simulations are useful for forming attitudes	Group activities such as role-playing are often useful for attitude formation	Generally not useful

*Individualized Learning Packages; Assignments; Tutorials

MEDIA SELECTION TABLE

	Categories of Media				
Types of Behavior	OBJECTS	STILL PICTURES	MOVING PICTURES	AUDIO MEDIA	WRITTEN MATERIALS
COGNITIVE Knowledge Comprehension Application Problem-Solving	Especially useful with demonstrations. Can be used to teach -recognition and discrimination -rules, principles or sequential steps.	Very useful for all levels of cognitive instruction. Can highlight stress concepts by displaying words, lists of steps, pictures and pictorial segments. Can provide visual cues.	Useful for showing content not otherwise easily brought into the training situation. Usually too costly for presenting still visuals and/or narrative audio.	May have their greatest use when in conjunction with printed matter or projected visuals. Useful if sounds of machines, alarms, etc. must be learned. Inexpensive.	Excellent media for all levels of cognitive instruction. Relatively inexpensive, printed materials allow for self-pacing. Can be used effectively with still pictures and audio materials.
PSYCHOMOTOR	Useful for teaching and trainee practice of performance in manipulating tools and equipment. Especially appropriate for on-the-job training. People can be used to demonstrate physical actions.	Little application. Can portray static positions of moving persons or objects.	Very useful. Can be used to: -model skills requiring motion -slow motion for close examination -provide visual feedback of student performance -demonstrate processes which take place over an extended time period.	Recorded audio materials generally useful in training only when demonstrating speech or hearing-related skills.	Limited application. since motion is difficult to represent. One important use is procedure guides or checklists for skills performance.
AFFECTIVE	Limited application. May be useful if the object is the focus of the desired attitude formation.	Limited application. Slides in combination with audio materials may influence attitude formation.	Excellent for influencing attitudes. Special effects and other visual techniques are especially useful for presenting affective material.	Limited application. Possibly useful for establishing moods or attitudes with background music, special sounds, or unique narration. May be used with slides to influence attitude formation.	Very little application for training materials.

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GLOSSARY

Adaptive Instruction - a means of bringing instruction under some aspect of learner control

Affective Behavior - expressions of feeling or interest; the adoption of an attitude or belief; the motivation to do something

Check List - a list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job, behavior, etc.

Cognitive Behavior - actions which involve knowing, understanding or applying information; remembering or using facts or ideas

Demonstration - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment

Entering Competencies - skills and knowledge that trainees must possess before they are ready to learn the behavior specified in the objective

Evaluation - the systematic process of collecting, analyzing, and preparing information for the purposes of decision-making. The functions of evaluation in training programs are to determine existing capabilities of employees, to provide feedback to trainees, to practice using a new skill and to determine (or certify) the preparation of a trainee to do a particular job

Guided Discussion - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem

Instruction - external conditions arranged to help the student learn

Instructional Activities - activities an instructor plans and arranges to help students learn

Instructional Approach - the sequence of activities which an instructor uses to teach a lesson

Instructional Design - the systematic process of specifying the goals and means of instruction. Included are the stages of objectives specification, evaluation design, method selection, and lesson planning

Instructional Method - how content is taught

Instructional Objective - a statement that describes an intended outcome of instruction in terms of learner behavior. It describes what a specific group of class of students should be able to do under specific conditions and how well it must be done

Instructional Strategy - a prescriptive statement identifying the most appropriate instructional methods and learning activities for a specific type of desired performance.

IPW (Instructional Package Worksheet) - describes in detail and in order what must be done in order to teach a single objective

IRIS (Instructional Resources Information System) - is an automated information system managed by EPA Information Dissemination Project which acquires, reviews, indexes and announces both print and non-print instructional materials

Job - the occupational title or position held by an employee

Job Description - a statement(s) outlining areas of responsibility (duties) of a given position

Learning - involves a more or less permanent change in the ability of the person to do something s/he could not do previously

Learning Activities - things learners do to help them learn

Lecture - uninterrupted speech by which one presents information to others

Lesson - instruction which (usually) encompasses a single instructional objective. A set of lessons on related objectives comprise a unit or a module of a unit.

Lesson Planning Form - a standardized format on which a lesson is planned

Media - means or methods of presenting information aurally and/or visually

Medium of instruction - a channel of communication through which instruction is presented to the learner

Motivation - the process of directing, focusing, and energizing behavior toward the accomplishment of specific goals

Problem - a discrepancy or deficiency between the way things are and the way things ought to be

Psychomotor Behavior - physical actions, speed or agility; the performance of a particular body movement

Rating Scale - a list of skills or tasks, but with each so carefully defined as to permit the evaluator to judge the relative quality of the performance

Resources - anything an instructor or trainee uses during instruction as a resource

Task - is one of the skills or operations which belong to a specific duty or area of responsibility. Each task usually consists of specific and distinct steps for its completion.

Task Analysis - the act of dividing a duty into all of its components. It results in a list of everything an employee must do to advance the work to completion

Unit - instruction on a set of related objectives, each of which is taught in a single lesson